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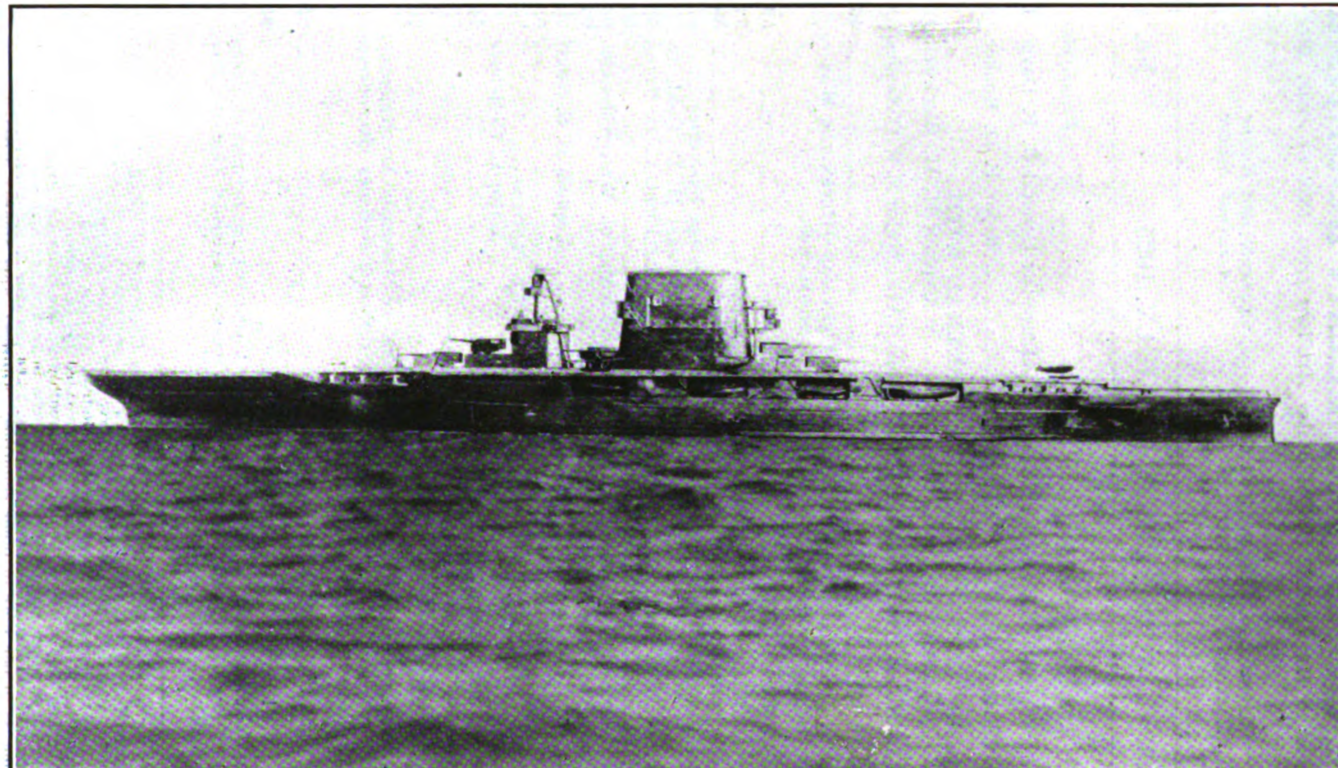

THE U. S. S. SARATOGA

A photograph of a model showing the vessel about as it will appear when placed in commission in 1926. *(For description see Editorial Page.)*

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The Hawaiian Maneuvers

By **Brigadier General Richmond P. Davis,** *U. S. Army*

Editor's Note: *General Davis commands the Hawaiian Separate Coast Artillery Brigade. The following letter was written by him in response to a request for information relating to the part the Coast Artillery took during the joint exercises. General Davis was greatly restricted in the scope of his letter, for, as he states, "an article would involve of necessity much that could not be published."*

THE mission of the Coast Artillery was to attack enemy vessels, to protect by fire the land utilities, to support by fire the mobile forces, and to cooperate with the 14th Naval District in the defense.

As we were confronted with the proposition that we did not have enough men to man all the armament, the important decision was to distribute the men with a view to getting maximum efficiency. This was accomplished by manning all observation and fire control stations, all searchlights, and the most important armament.

The armament not manned was designated as alternate armament and armament in reserve—the alternate armament to be manned in lieu of the primary assignment of any unit in the event that the action took a turn calling for minor rather than major armament.

You will see readily that the scheme made the maximum use of the personnel.

Our plan of action involved the standard tactical principles applicable to the operation of coast artillery units and to all situations. They may be enunciated under the following headings:

(1) Maintenance of constant and close observation.

(2) Maintenance of close liaison with the Naval District and adjoining units, and the establishment of challenging stations.

(3) Organization of forts against a land attack, holding under fire enemy troops attempting to land and meeting them on the beach with the bayonet in the event of a landing. Counter attacking in case of a foothold.

(4) Attack of battleships when within range. Fire very deliberate for extreme ranges.

(5) Attack of cruisers within range. Fire as for battleships.

(6) Attack of mine sweepers whenever near mine fields or within effective range—mine layers whenever within range.

(7) Attack of destroyers when attempting a smoke screen or when within range to be effective themselves.

(8) Attack of submarines when within effective range.

(9) Use of searchlights intermittently.

(10) Conservation of ammunition.

In order to have the highest possible state of efficiency at the time of the exercises it was necessary to begin early with conferences involving the probable operations of the Blue and Black Forces.

Committees representing the Blue and Black Forces were organized in each coast defense to draw up estimates of the situation, and orders covering the probable phases of attack. The results of their labors were presented at conferences at which all coast artillery officers were present and extended discussions were held. These studies and conferences were very valuable both for instruction purposes generally and for preparation in connection with these exercises in particular. It is worthy of note in this connection that one of these committees at Fort Kamehameha outlined in detail all the features of the Blue attack both as to time and place.

On the basis of these discussions tactical exercises were held, both on our war game board and with the troops in their battle positions. Thus we were prepared fully for the exercise when the time arrived.

Things worked according to schedule and the developments were entirely satisfactory. We put in stations and established our fire control system in such a way as to eradicate certain dead angles that were supposed to exist, and the units operated in all particulars in a highly satisfactory manner.

Close liaison existed with the adjoining units, and the communications were all that could be desired.

An item of very extreme interest is that ships were picked up and identified at 20,000 yards and followed several thousand yards on their course before they were lost. There are various other items which may not be mentioned but are of interest.

To sum up both in their preparation and execution, these exercises were the most valuable that I have ever experienced and I believe them to be the best military exercise of any character which has been held by any of our national defense forces.

Some of the coast artillery units were with other commands—how they performed may be judged from the following quotations:

"Now that the Joint Army and Navy Maneuvers are over, I wish to record in this official way my high appreciation of the splendid work performed by you and by the batteries which formed the -------- Battle Command. The success of these exercises resulted very

largely, in my opinion, from the immense amount of work which was done in preparation for them. Never did officers and enlisted men take a keener or more active interest in a military problem. The maneuvers involved a great deal of very hard work, but your officers and men went about it as if they enjoyed every item of it. The result was a complete success. Will you please inform the personnel of the batteries which formed your command how highly their work was appreciated by every superior who had the opportunity to observe it."

"Please accept my congratulations upon the efficient manner in which your command performed their missions during the recent Joint Army and Navy Exercises."

"The enemy information you furnished was prompt enough to be of great value."

And then again service of one of the coast artillery units in connection with a regiment of another branch should be of interest as illustrating an example well worthy of emulation at all times.

"The assistance rendered by officers and men of your command to the -------- Infantry in preparation for and during the period of our recent encampment on your target range, is thoroughly appreciated by this regiment. Prior to our arrival, you cleared a large amount of ground; when trucks of our advance detachment became bogged in wet ground, you extricated them with your tractors; you strengthened our system of water supply by the loan of your water carts, and in short, cooperated with us in every way. On behalf of the officers and men of the regiment, I thank you for this fine cooperation, which rendered easy what would otherwise have been a difficult problem."

Another example of the good relations existing between the troops and civilians during the maneuvers is illustrated in the following:

"We wish to take occasion to compliment the Hawaiian Department of the U. S. Army for the attitude, during the recent maneuvers, of the units in the field in that section of the country where we are operating.

"We are frank to admit that past experience had led us to anticipate a certain amount of friction with these units, as well as expect that considerable damage would be done in our fields. The

least we can say is that we were very pleasantly surprised. The courteous attitude of your officers in arranging for placing of telephone and telegraph wires, locating camps, using roads, as well as the behavior of the men camped on or near our property, left nothing to be desired from a standpoint of pleasant relations between the Army and ourselves.

"As we are quick to make complaints when we feel that our rights have been trespassed upon, we wish also to be as quick in expressing our satisfaction over the pleasant contact during the past few weeks."

The Department Commander expressed his views in the following:

"The Department Commander desires to express sincere appreciation of the excellent conduct, the keen interest and the high efficiency of the personnel of your command during the recent Joint Army-Navy Exercise. It is gratifying to him to inform you that all observers, civilians, officers of the Navy, and Umpires, concur in commendatory comments upon the high standard of conduct, training and morale of the personnel of the Hawaiian Department.

"The Department Commander, knowing that the success of the Exercise was largely attributable to the zeal, efficiency and morale of the rank and file of the Hawaiian Department, desires to commend especially such personnel therefor."

Outguessing the Instructor

By MAJOR P. D. BUNKER, *C. A. C.*

"Have you guessed the riddle yet?" the Hatter said, turning to Alice again.
"No, I give it up," Alice replied. "What's the answer?"
"I haven't the slightest idea," said the Hatter.
"Nor I," said the March Hare.

LEWIS CARROLL.

IN THE dim and distant past when I was a boy, we had a game of marbles known as "odds 'n' evens." It was a great game. You held in your closed hand or hands a certain number of marbles and rattled them as alluringly and deceptively as might be. The party of the second part was supposed to guess whether the number of marbles so concealed was odd or even. If he guessed right, he won the handful for his own, in fee simple; if he guessed wrong he gave you as many marbles as you held in the said handful. Observe the beautiful simplicity and fairness of the game! Absolutely no "percentage in favor of the banker," and your possible gains were in exact proportion to your ventures. If you chose to rattle a large number of marbles (a matter of pure choice) you might win (or lose) that same amount. In other words, you could play as mild or as stiff a game as you pleased. And the chances were precisely even. Show me a game of the "grown-ups" as fair as that!

And yet, mathematically fair as the game was, it quickly developed that a boy's winnings were in direct proportion to his brain power; you could measure a boy's intellect almost exactly by the number of marbles he won. (No, Gentle Reader, I made no mention of my own winnings; please don't interrupt). It worked out something like this: Suppose Tommy Jones held, say, five marbles in his hands and Bill Green guessed there were but four; upon Tommy's showing the marbles and convincing his opponent of his erroneous judgment the latter would pay Tommy five (count them) five marbles. Whereupon Tommy would start the game anew by concealing another covey of marbles—and right here is where the brains came in. Tommy would size up his opponent in a fashion roughly as follows: "Bill is what the crossword puzzle calls an oaf; he guessed even, last time, and lost; he'll guess odd this time and expect to win; so I'll change, too, and hold an even number of mar-

bles this time." Or, if he were up against a brighter boy, Tommy might "estimate the situation" differently, to-wit: "Jack here is not so dumb; he knows I held an odd number of marbles last time and won; he thinks I'll change to an even number this time just to fool him; he's going to try to outguess me by repeating his former guess; so I won't change this time, I'll hold an odd number of marbles again."

For a third "special situation" assume a still wiser opponent, and Tommy's cogitations might assume the following tenor: "Jim is awfully smart, and he knows that I am smart, too; I beat him last time by holding an odd number; he gives me credit for more sense than to merely shift to an even number this next time; he thinks I'll try to double-cross him by sticking to 'odd' expecting him to do the shifting; so he is going to guess 'odd'; I'll hold an even number this time, just the same as if I were up against a regular nitwit."

Let's take no further steps in this analysis of reasoning; its higher complications become embarrassing. The illustration has served its purpose. You see what I mean. The main point is that Tommy Jones has open to him two courses of action—to change or not to change. "In this situation" if Tommy decides to change from odd to even then his opponent loses out, be he stupid or clever; only the mediocre boy would win.

Just another illustration of "outguessing" to clinch the point. This one might be termed an "historical example." It seems that on the American Front near Vieville there was a German heavy battery that was regularly and perniciously active at a certain hour every night. It would fire a rapid and heavy burst and then, when the American heavies would open up in counter-battery, no more would be heard of it until the next night, when it would open fire again as per schedule. By means of sound-ranging this battery was finally spotted as being in the opening between two hills, as indicated in Fig. 1.

When this information was furnished to the Yankee artillery they reacted roughly (sic) as follows: "Aha!" said they, "we know what Fritz is up to now. He runs his guns in there on those two tracks every night, gives us a few salvos and then beats it back over the railroad to the rear areas. We'll teach him a new one! Wait till he opens up tonight and we'll put a sweet concentration of fire on that switch just about the time his guns get on their way to the rear. Let's see how he will laugh *that* off."

The idea seemed to have much to recommend it. The performance was staged that night exactly as planned and, after it was over, the Gringos chuckled in high glee to think of the joke they had perpetrated upon the wicked and unsuspecting Boche. But, to their

astonishment, the same German guns opened up again the next night right on the same old schedule, fired their salvos as before, and were treated to another dose of counter-battery and interdiction fire. The succeeding night was the same, and so were the following nights; the Germans seemed to have some weird method of hopping over or around that switch, on their way back. It was not until this terrain came into Allied possession that the puzzle was solved, and the solution was absurdly simple, after all. Contrary to expectations, the German guns were not on railway mounts at all, but were permanently located at "A" (see Fig. 1) about midway between the ends of the two railroad spurs, in carefully concealed emplacements. Incidentally, these emplacements were far enough from the spurs to escape

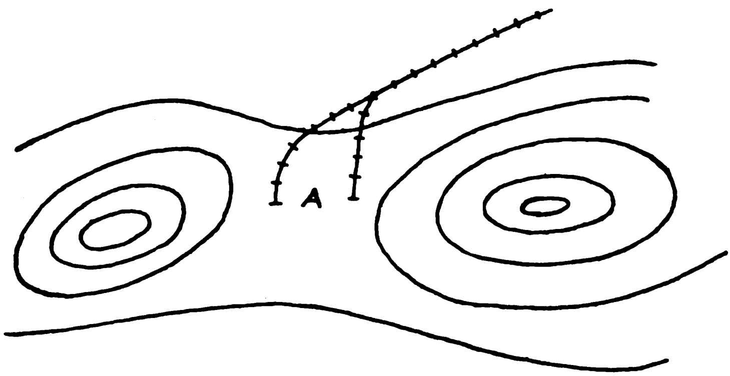


Fig. 1

well aimed shots fired at the latter. As a consequence, the guns of course had no relation whatever to the switch; they fired their nightly allotment and then simply lay doggo until the next night. Conclusions may easily be drawn as to who did the outguessing in this case.

These illustrations have led us (rather neatly, I think) to the title of this theme—"Outguessing the Instructor." But before proceding further with this topic, let us dilate for a moment on a point or two which may be obscure to those of us who have not, as yet, attended a special or general service school.

In these days of map problems and terrain exercises it is, perhaps, unnecessary to state that the cryptic symbol "CU" is the brand and stigma applied to a solution which ranks, in merit among the lowest of the low (that is, in Grade "C") and, by virtue of the suffix "U", is alleged to be "unsatisfactory." If your paper draws a "C" you may feel properly humiliated, but you do not alto-

gether lose hope of salvation. On the other hand, if your solution draws a "CU" it is as if you missed a six-inch putt on the eighteenth green—can anything be more devastating? I pause for a reply.

The person who marks your paper intends to convey, by means of the aforesaid symbol, the fact that your solution, in his opinion, seems to lack one or more of the elements of Success. In the school with which you may happen to be familiar there is, perhaps, a different system of marking, but it is safe to venture the assertion that it includes a counterpart of the "CU."

So it is to my Fellows of the Humble Order of the CU, my brother Knights Errant in the profession of Map Problem Solution that I bring this message of glad tidings. To them I say, "Be of good cheer; we are not the ivory-domes the instructors think we are; we are simply proving ourselves their mental superiors by outguessing them. Be not dismayed at a solid string of CU's; naught is lost thereby save honors."

Now, let's go into this thing a little more in detail. The first step is to analyze our subject, our *casus belli.* The CU Club would not be misunderstood as thinking that, *ex officio,* every instructor lacks judgment, poise, and a heart. Not so! In our long and checkered careers we have spent perhaps a third of our time under "Instructors" and until the final "Taps" puts a merciful end to their struggles in our behalf we must expect to spend considerable more time in the same way. So "get in bad" before we start? The Club therefore maintains that it is good psychology (and sound strategy) to prevent our instructors-to-be from forming erroneous opinions as to the very high esteem in which the Club holds their abilities, patience, and perseverance against overwhelming odds. Besides, we ourselves might be instructors, some day!

There are those who claim that an officer, upon being detailed as instructor, immediately puts into cold storage his equipment of reasonableness and humanity, if any, wraps about him a cloak of superiority and bigotry and stalks forth to bring dismay and despair to the souls of his erstwhile comrades. This view, of course, is held by the extreme Left Wing only. Until instructors are drawn from a source different from the present one it is evident that they must be of the same clay as the students. Occasionally an instructor may seem to adopt the "holier-than-thou" attitude, but this usually happens only in the case of a comparatively young and inexperienced officer. There are, also instructors who can see nothing but the book solution of a problem; to them any other solution is anathema. Such a frame of mind is indeed unfortunate, not only for the student, but also for the instructor himself.

This attitude may react injuriously on the student in one or more of several ways. In the first place, the student may be a sulphite and not a bromide and his solution, while differing from that in the book, may nevertheless have points of excellence. To assume that there can be no points of excellence except those in the book solution is to assume that the authors have penetrated to the full depth of human knowledge and to be infallible, and that the art of war is an exact science—assumptions that few of us would care to make. Now, if this student's solution, without credit for its intrinsic value, is to be swept into the discard with a summary "CU" simply because it differs from the book solution, the student naturally feels either bewildered or resentful, perhaps both. He may begin to suspect that this particular instructor is so uncertain of his subject that he dares not trust himself away from the book solution. In such a case the student may sooner or later deduce the not unwarranted conclusion that there is but one acceptable solution—the one in the book. He says to himself: "They keep telling us that the book solution is *a* solution and not *the* solution and that most problems have more than one sound solution. But I've noticed that the further you get from *a* solution the lower mark you get. There is something in this Shakespearian quotation about 'Methinks the lady doth protest too much.' Why don't they call it 'THE approved solution' and be done with it?"

It is probable that such a state of mind among the students would be sufficient in itself to kill the prospects of success of any course which was a purely voluntary proposition, that is to say, in National Guard or Organized Reserve circles. It therefore follows that, if the course is to be a success in such cases, the *why* of everything must be shown in clearest terms. Each solution must be treated as a personal matter between the instructor and the student. It will not do to pencil "12" or any other number opposite an alleged error and expect the student to rest satisfied with looking up that number in a List of Comments. He wants *personal* attention, man-to-man stuff, and if he does not get it he may quit the course entirely. He probably figures that he has given of his own spare time to the problem and is entitled to a certain amount of the instructor's time and attention.

So, if a student's solution is found to be defective, one must be extra careful to show the *why* and *how* of the matter; it is not sufficient to say, "This is the right way." If we cannot show conclusively that the student has overlooked or violated some vital principle of war, if he has submitted a solution that is well carried out—even if the decision itself is not of the best—should we not remember the axiom that "A poor decision well carried out will usually win

over an excellent solution poorly executed"? Should we not, in such a case, say, "This appears to be a good solution of the problem"?

Such a concession, even if it happens but rarely, has a wonderfully beneficent effect on the morale of the student. It also has its good effects on the instructor himself. The reverse is also true. If we habitually blind ourselves to everything except the book solution it would seem very easy to build for ourselves a reputation for narrowmindedness that will surely react upon us in the future. Concerning one of the highest type and most efficient officers of our service it is said that one of his principal characterisitcs is his ability to "see the other fellow's side of the case." Such an officer realizes that to receive and welcome new ideas is to broaden his intellect, even though some of the new ideas are erroneous.

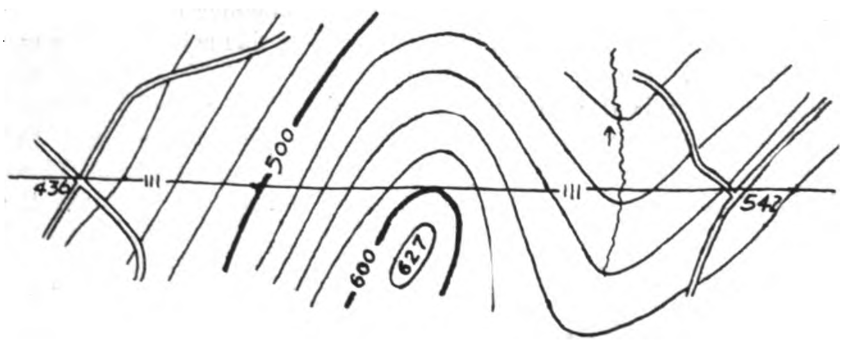


FIG. 2

Luckily, the bigoted instructor seems to be so rare that he is correspondingly conspicuous and, once recognized as such, the student makes allowance accordingly. As a case in point and in deference to the wise saw that an illustration does much to "adorn an otherwise bald and unconvincing narrative," let us cite the situation shown in Fig. 2. This case, by the way, did not arise at any of our service schools. It seems that a boundary between two adjacent units was specified as being, "Crossroads 436— *North end* of hill 627—roadjunction 542—etc." The point was—exactly where is the north *end* of hill 627? The north slope seems to be so nearly uniform as to prevent anyone from deciding even approximately where this point is. It was evident, from the context of the solution, that the originator of the problem intended the boundary line to touch the 600-foot contour, an admittedly vague landmark. But due to a slip such as befalls even Jove at times, an unfortunate wording was used, although some easily recognizable landmark

could and probably would have been used if the originator of the problem had been that rare sort of being that never makes a mistake. Of course, this particular error was of negligible importance, and the author of the problem would probably cheerfully admit the mistake and correct it on the spot. And yet, it is said, one officer, acting as instructor, undertook to justify and defend this *lapsus linguae.* Whether or not his efforts were successful can be judged from a subsequent remark by one of his students: "Ye gods! If they would only admit just once that they aren't perfect! I'd go at it then with a new zest and feel that there is some hope for me."

There is another type of instructor who causes considerable demoralization in the ranks of the students. He is the one who deals only in glittering generalities, never allowing himself to be pinned down to definite facts and figures. His pet remark is, "It depends on the situation," which remark, in varied guise, is more ancient than the Golden Fleece. Psychology bids us doubt the justice and soundness of any saying which brings a smile to the lips of the audience; this is a pat illustration. Utter that sentence in the hearing of any number of students and note the reaction. Of course the statement is incontrovertible, but that does not help the student who is looking for some sort of guide through the maze of tactics. For example, a student may want to know in a general way, what frontage a division of the defensive can cover, whether it is one mile or ten. The instructor could answer that "it depends on the situation" and very properly so if the student is looking for a yard-stick to apply indiscriminately to all cases. However, if the instructor refuses to deal with concrete cases at all then the student has no clue as to which of those two limits would be the more nearly correct in any case. Later the same student might find himself severely cut for "over-extension" if he deployed his division on a frontage of over four miles. The point to be made here is that if there are rules which justify "cuts" then it would seem that these same rules are good enough for instruction purposes.

From the foregoing remarks anent a few selected "horrible examples" it should not be thought that instructors constitute a class of disagreeable personages, to be tolerated as a necessary evil. Such is far from the truth; most of them are ready and anxious to work their heads off to help all who ask for assistance. And this is not for the selfish reason that a generally poor showing, by the students, in the problems relating to their (the instructors') subjects tends to show inferiority of instruction rather than inferiority on the part of the students. Moreover, most of them are ready to admit, as the fruit of experience, that a perfect map problem is a very rare bird.

So far, in this paper, we have kept the Instructor under the microscope. Let us now put the Student in the same enviable position. The former has presumably "been through the mill" in some form or other, and hence constitutes a more nearly uniform product than the latter; that is about the only difference. In other matters the characteristics of the two classes are about the same, and inevitably so, since both are drawn from the same great reservoir. There is a difference, however, in their complexes due to the fact that one "hands it out" and the other acts as receiver.

And so we should expect to find about the same proportion of openmindedness in one class as in the other. Most of us are acquainted with the man who says, "Well, they gave me a C on that one, but it looks as though I deserved worse; I missed it by a mile." On the other hand, most of us are also acquainted with one or more of our compadres who would never admit, under any circumstances, that they had made mistakes sufficiently serious to warrant a "CU."

Another type of student is the one who "fights the problem"; he rails against its style, construction, and diction, and attributes his marks (usually low) to the fault of the problem and not to his own errors. He spends so much time in picking flaws in the problem that he has but little time left in which to solve it, and so the last days of that man are worse than the first. There is but one sure cure for such a malady—have him make up a problem himself! After he has worked himself into a lather trying to compose a problem that will at least hold water he will realize that the operation is far more difficult than it looks. Thenceforth he will be decidedly more lenient if not actually indulgent when perusing the efforts of others in this field of endeavor.

It has repeatedly been remarked that officers who are experts in certain lines frequently make poor marks in problems relating to their specialty. It is frequently said that cavalrymen will fess on military problems and then max the infantry problems, that an artilleryman will receive severe cuts on the disposition of his regiments and then carry off the blue ribbon in such a ticklish event as a "position in readiness," incidentally beating out some of his friends in the infantry who, in turn, have just been sunk without a trace but had previously pulled off a highly successful cavalry reconnaissance. And for the other branches, no change.

At first blush this looks queer; but on close scrutiny the abnormality decreases. The whole answer does not lie in the statement that the problem itself is defective although, of course, a certain percentage of them must in all honesty be placed in that category. Map problems are the fruit of human brains and not of divine inspiration, and hence perfection is rarely to be expected. It is be-

lieved that the real answer is often to be found in the student himself, especially in the case of map problems which have been promulgated within the last few years. Probably most of these problems were drawn up for the special purpose of illustrating the application of one or more previously selected principles of tactics or of strategy. Sometimes there has been inserted subsidiary conditions—"camouflage," if you wish—so that the application of the principles will not be too staringly obvious. Of a necessity, the problem is written for the average officer, not for the expert; the stated conditions must be suited to their main purpose of educating the *average* student. Herein lies the peril for the expert. The lesson which the problem was designed to teach looks so elemental and obvious to the highly specialized officer that, to him, it looks altogether too easy, and he immediately casts about for the Senegambian in the woodpile. Naturally, in his search, he sooner or later finds some unobtrusive and ostensibly innocent statement in the situation which rouses his suspicions, and this he takes as a new line of departure because he does not want to "jump at the conclusions" indicated by the seemingly too transparent situation. Actually he does jump at conclusions just the same, but in the opposite direction; he jumps at the conclusions which he has deduced from the imaginary joker in the problem. On the other hand, the officer with less expert knowledge accepts the problem as stated on its face; to him the solution does not appear excessively easy or obvious and so he does not pass over the prima facie evidence in the case and look for subtleties. He puts all his energies into solving the bald, unadorned situation as it appears to him and, assuming that he has the average good judgment, makes a decidedly better score than his admittedly more brilliant brother of the expert knowledge.

The expert has tried to outguess the instructor in this case and, possibly, has succeeded. But the marks issued for the problem will not console him for that. The non-expert who did the obvious thing and lacked the advantage—or rather disadvantage—of highly specialized knowledge, probably secured the higher mark. Very often, when we receive the approved solution, we recognize it as an old acquaintance; this is because it is a solution which we though of and almost used, but finally discarded as being too simple. We thought it represented the "odd" guess in the marble game, so we evolved a better (?) solution, guessed "even" and—scored a clean miss.

There is another aspect to this "expert" proposition. Some of our officers acquired a great deal of experience, valuable and otherwise, in the late quarrel with Germany. They saw certain things done in certain ways, and successfully at that. From this

they drew the conclusion that these were the only correct ways of doing these particular things. Whereas it seems generally conceded that many of the things done during the war were done in certain ways because these ways were necessitated by very special circumstances. This leads to the corollary that many things were done in the war in a way that was and is all wrong, a way that should not be used unless other and better methods are prohibited by circumstances. This fact, overlooked by some, leads them into erroneous decisions in the Map Problem Room. They say to themselves, "This is the way we did it in La Belle France"—and they write it down that way. Later they may find out that while that was the way we did it in France, we would do better not to admit it in public.

These two causes, possibly more than any others, would seem to be the bases of the oft-repeated allegations that the more a student knows about a subject the lower will be his marks in that subject—as measured by map problems. Perhaps many of us assiduously keep such allegations alive and cherish the memory of one or more proofs that have come to our ken—all in the spirit with which the little boy whistles in the dark. There's a lot of consolation in it, what?

Upon analysis we might arrive at the opinion that one or both of these "causes" just mentioned may have their root in the spirit of emulation which is such a marked characteristic of the classes at all service schools. This rivalry sometimes approaches in earnestness a real "struggle for existence," an unhealthy intensity caused primarily by placing an exaggerated valuation upon class standing. To quote from the address of the Commandant of the General Service Schools at Fort Leavenworth on September 8, 1924:

> Your class standing will be determined solely and entirely by your scholastic work during the ensuing year. No other factors enter.
>
> Your efficiency reports for the nine months ending on June 30 will be based solely and entirely upon your work, conduct and bearing during that period. No other factors enter.

So it is seen that an officer's efficiency report during a school session carries other items beside class standing. The fairness of this is all the more apparent when we reflect that (at least in those service schools with which I happen to be more or less familiar) the only scholastic work for which marks are awarded consist solely and exclusively of map problems—and the closely related subject of Terrain Exercises. As a necessary result, presumedly, an officer's standing in the class is measured only by his ability in this comparatively narrow field. To claim that an officer's ability to solve

map problems is a criterion of his general efficiency as an officer would be as logical as to claim that Jack Dempsey must, of course, be a prize-winning pole-vaulter.

That is not to say that ability to solve *sound* map problems and *sound* terrain exercises (after you know the rules of the game) is not indicative of capability for general staff work and for command of *large* units. On the contrary, there seems to be trustworthy evidence that such is indeed the case. But be that as it may, just because an officer makes 90 per cent of "A"s is no reason for assuming that he can train a battalion or administer a regiment or lead a forlorn hope. In fact, the contrary has conclusively been demonstrated in more than one case. The scope of the duties of an officer is too wide and varied to permit such a deduction. This is the reason the CU Club asserts that the man who stands well down in the class should not necessarily feel disheartened on that account. It is said that General Grant was a member of the "goats" when he was graduated from West Point.

If only some means or methods could be evolved whereby the officer's daily work throughout a wide scope could be rated and entered as a factor of his class standing, the resultant figures would more closely measure his general mental (and physical) qualifications and abilities. This must not be construed as a diatribe against "class standing"; perhaps nobody ever stood willingly at the foot of a class. It is intended merely as a reminder to those of us who reap fewer "A's" than we would like, that ability to solve map problems, while an enviable asset, is a gauge which is too narrow to measure our own sterling worth.

But, accepting things as they are (and they are in as good shape almost, as we ourselves could arrange) our standing is a result of map problem and terrain exercise work alone; they are the things that count, and so the student can hardly be blamed for striving, tooth and nail, for the highest obtainable mark in those subjects. Personally, we may prefer to spend our few leisure moments in fruitless endeavors to cure an execrable "slice" or in researches concerning a three-letter word meaning "island," but that does not license us to criticize the other fellow for preferring to spend his time delving in last year's problems. Rivalry is an inevitable result of the system as it would be, probably, of any system that could be devised. And, kept within healthy bounds, I know of no one who deprecates its existence.

In this rivalry, however, there are a few facts which we should keep constantly in view. The first is that the map problem itself is not one of our rivals; nothing can be gained and much may be lost by "fighting" it. Map problems originating at the General Service

Schools, at least, must be "guessed right" by three separate officers working independently for the solution, before the problem is ever approved for issue. The second fact to be remembered is that the instructor, likewise, is absent from our list of rivals. Let us then give over our attempts to outguess him. In the first place, it can't be done; he is on the right side of the book. In the second place, even if we *do* outguess him he should worry; we are on the receiving end and not he. The only safe method is to take the problem as it is, in all its horrible details, treat it like any other puzzle, strive for a common-sense solution that will hold water—and let the CU's fall where they may.

An individual instance of the failure of wartime experience to measure up to the roseate promises of today is that of the *Konigsberg*. When raiding activities could no longer be maintained this cruiser was marooned in a shallow river in German East Africa. Here she lay, as helpless as a target ship, with the one exception that she had her antiaircraft guns. The British brought down two seaplanes to bomb her. In the face of the antiaircraft fire they proved unequal to the task. After several attempts one of them crashed into the sea and was wrecked. Then the Admiralty sent down two monitors, and with seaplanes spotting for the indirect fire—just the kind of auxiliary service which all admit is invaluable—the *Konigsberg* was quickly destroyed. *—Lieut. Commander Sidney Ballou in the United States Navcl Institute Proceedings.*

Problems for the Coast Artilleryman with Suggestions

By Captain H. H. Blackwell, *C. A. C.*

Theory of Errors and its Application to Changing Values

FOR the purpose of this discussion the following classification of errors is made: (a)—Accidental Errors. (b)—Constant Errors. (c)—Variable Errors.

(a) Accidental errors occuring in artillery fire are errors of individual shots as measured from the true center of impact to which no known cause may be assigned. These errors as such are never corrected for. While all methods of adjustment make use of these errors as a basis for correction, yet if they were determined their value would have to be subtracted from the deviations in order to find the necessary correction to apply. For example, suppose a shot struck 200 yards over the target and we knew that the accidental error of that shot was 100 yards over the center of impact, we should obviously know that the center of impact was 100 yards over the target, and correct accordingly. The deductions that may be drawn from the above are that *accidental errors require no correction*, and that if accidental errors can be determined, so as to permit their elimination, adjustment would be a simple matter. If we had only accidental errors to contend with we should need no adjustment. All that should be necessary to know in order to obtain the maximum fire for effect would be the map range to the target, and with a range scale once adjusted at the arsenal the center of impact would always be on the target if its map range were set on the range scale.

(b) Constant errors as classified here refer to those errors which have a constant value and are not affected by changing conditions. For example, errors in the determination of the map range of any particular target, or errors in the computation of the range table, etc. These errors occur to the same extent any time these incorrect values are used. These errors require adjustment, but once corrected for are eliminated. If that were the only kind of error for which we had to correct, adustment would be very easy. An error of this kind would be detected early in the series, and corrected for,

after which fire for effect may be maintained indefinitely without further need for adjustment.

(c) Variable errors are errors which have a variable value, depending upon changing conditions. These errors are what make the adjustment of fire a problem. They follow no definite law, as in the case of accidental errors, but they have certain characteristics which should be considered in any method of fire adjustment. Were an error of this kind known at all times we could assign it no definite value. However, its value may be indicated by a curve from which a definite error may be determined for any specified time.

This variable error occurs in firing at a stationary target as well as in firing at a moving target, only to a lesser degree. We have no means of absolutely separating this kind of error from the others in order to study its characteristics, but we can reasonably assume that a curve of ballistic corrections as plotted on the time range board with our present system of fire control for guns is representative of this error. The chief characteristics of this curve are that it has no sharp breaks, and it is possible to predict thereon for the value of future corrections.

In our text books on gunnery we are told that "errors" refer only to the deviations from the center of impact, and the deviations from the target are not "errors" but "deviations." In this discussion, no such distinction is made, the deviation of the shot from the target being the total error of that shot, which may be caused by any of the above classes of errors or any combination thereof. Since the true center of impact is kept near the target, with any good method of adjustment, we should consider the deviations from the target as deviations from the true center of impact, or "errors." If the probable error of the armament is known the accuracy of the above assumption, as well as the efficiency of adjustment, may be readily ascertained by the relation of the armament probable error to the developed probable error.

If the probable armament error is 100 yards, and in firing a series of shots we develop a probable error of only 100 yards (deviation from the target taken as errors) then the efficiency of adjustment is 100%. But suppose we developed a probable error of 150 yards, then the efficiency of adjustment would be 100-150, or 66-2/3%. As a further illustration of the comparative value of this test of efficiency let us assume a condition where an error exists at the beginning of a shoot of minus 100 yards and at the conclusion this error was plus 100 yards, this error being a variable error. If no corrections were made and the accidental errors followed the law of probability the center of impact of the series would have been on the target and according to our present method of analysis would

indicate perfect adjustment. But if the developed probable error were computed it would be found to greatly exceed the armament probable error, indicating the lack of proper adjustment. The problem of adjustment is not so much a matter of keeping the center of impact on the target as it is of keeping the dispersion from the target a minimum. If the latter is accomplished the former will of necessity result; a relation which does not exist conversely.

To correctly apply the theory of errors to the adjustment of fire at a moving target two considerations are fundamental: 1st, we must consider our "yardstick," or unit of measure, and 2nd, we must consider the quantity or distance to be measured. Our measuring instrument is the elevation, or range scale on the gun itself, and the quantity to be measured is not the actual distance to the target, nor the true center of impact of the gun, but the angle of elevation necessary in order to hit the target. This value is otherwise known as the ballistic range of the target. The range table, for convenience, assign certain values in yards of range for corresponding elevations which are true only under certain conditions.

The point that the artilleryman must keep in mind is that the ballistic range to the target is always the unknown quantity, and can not be determined from the map range with a great degree of accuracy, even though the latter may be accurately determined. The problem of adjustment of fire consists, first, in measuring the ballistic range to the target using the gun as a "yardstick," and second, in setting the gun at this ballistic range.

The use of "ballistic range to the target" as the unknown quantity, instead of "true center of impact of the gun" is the key to the proper application of the theory of errors to adjustment of fire on a moving target.

As an illustration, let us consider the following problem: the target is stationary, at a distance of 10,000 yards frm the gun; find the ballistic range to the target.

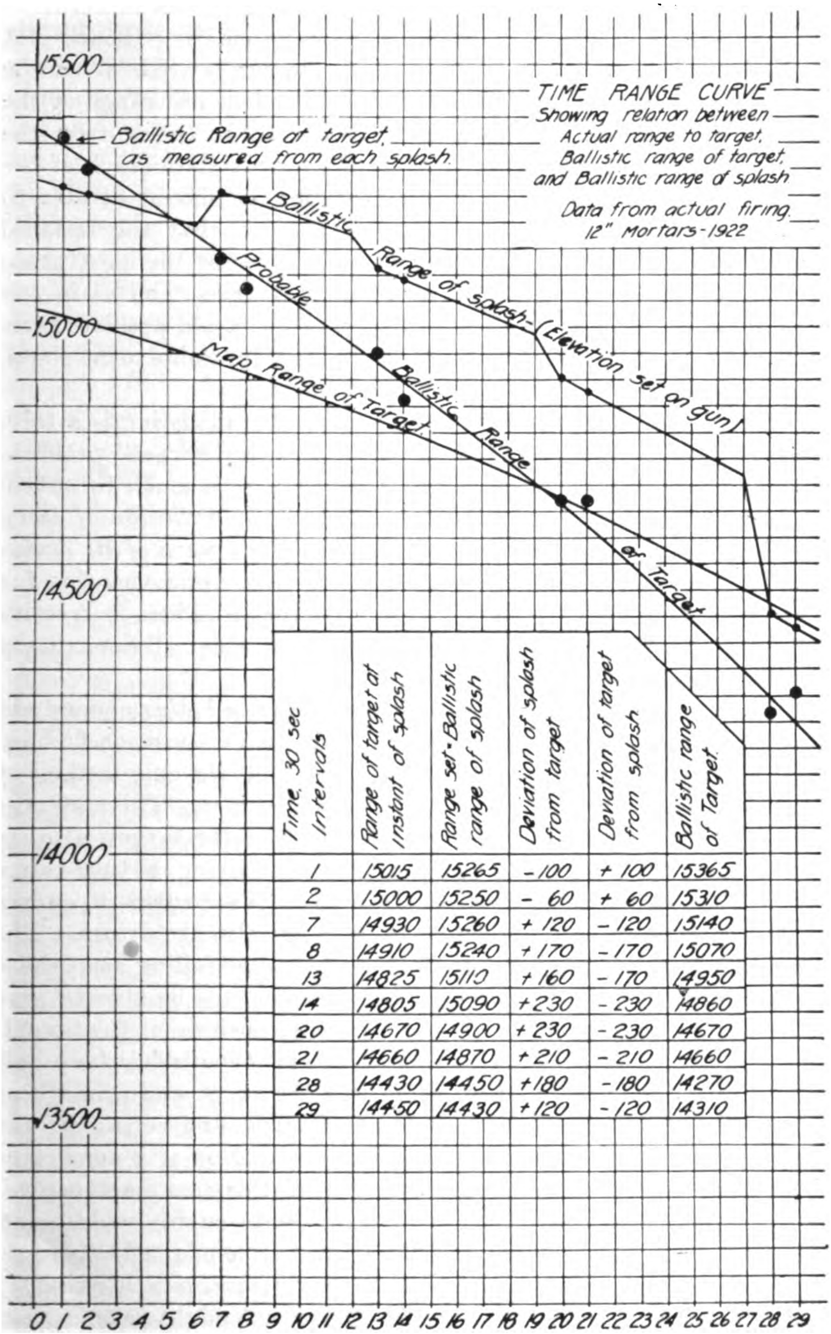
The approximate ballistic range for the 1st shot is computed from the map range with corrections for any known abnormal conditions affecting the flight of the projectile. The first value is, at best, only an estimate of the ballistic range of the target. Suppose the value thus determined to be 10,200 yards. If this shot falls 100 yards short then the ballistic range of the target as shown by this one measurement is 100 yards more than the ballistic range of this shot, or 10,300 yards. If three more shots were fired at the same elevation as the first with the following deviations from the target; 200 short, 50 over, and 150 short, respectively, then we would have the following measurement of the ballistic range of target: 10,300, 10,400, 10,150, and 10,350, or a mean value of 10,300.

The difference between this method and the one commonly used lies in the fact that the distance between target and splash is referred to in the one case as deviations of the *target* from the *splash* and in the other as the deviations of the *splash* from the *target.* It is more logical to go from the known to the unknown. The ballistic range of the splash is always known from the moment the shot is fired.

If the ballistic range of any particular target were a fixed quantity, then the mean of the measurements of this quantity as determined above would give a value for the ballistic range of the target, the precision of which value being in direct proportion to the square root of the number of measurements. Adjustment in this case would be a comparatively easy matter. It is unfortunate, however, that, even in the case of a stationary target, this unknown quantity, the ballistic range, is not a fixed quantity, but a variable quantity, changing in value momentarily. In case of adjustment on a stationary target this variation may be ignored without appreciable error, provided the series of measurements cover a short period of time. But as long as we ignore this condition in the adjustment of fire on a moving target, so long will we be without any effective method of adjustment. The problem that presents itself is a means of determining a variable quantity from a number of observations and applying the theory of errors thereto in such a manner that a mean value of this quantity may be known for any particular time.

All text books on the theory of error treat this subject in its application to the measurements of fixed quantities, and it becomes necessary for the artillery to develop practically a new science in order to apply the same principles to the measurement of changing values. The fundamental difference is a mathematical difference between a *point* and a *curve.* If the true value of the ballistic range of the target were known at short successive intervals of time, and these values plotted as ordinates and the time intervals as abscissae we should obtain a curve which by interpolation would give us any of the values for the range for any particular moment covered by the series of observations. The most important characteristic of this curve is that of continuity, its range value being solely a function of time.

In the case of adjustment on moving targets the theory that the arithmetic mean of a number of observations is the most probable value is a fallacy; the most probable value may be indicated by a time differential curve drawn on a time range board so as to assign a minimum value to the sum of the squares of the residual errors when the observations are plotted on a time range basis. A mathematical consideration of this theory is very difficult, and for that reason will not be undertaken in this discussion. However, a graphic



Time, 30 sec Intervals	Range of target at instant of splash	Range set-Ballistic range of splash	Deviation of splash from target	Deviation of target from splash	Ballistic range of Target
1	15015	15265	-100	+100	15365
2	15000	15250	- 60	+ 60	15310
7	14930	15260	+120	-120	15140
8	14910	15240	+170	-170	15070
13	14825	15110	+160	-170	14950
14	14805	15090	+230	-230	14860
20	14670	14900	+230	-230	14670
21	14660	14870	+210	-210	14660
28	14430	14450	+180	-180	14270
29	14450	14430	+120	-120	14310

Fig. 1

solution is very simple and for all practical purposes is accurate enough. We should proceed as follows: On a time range board plot the ballistic range of ecah shot as soon as the gun is fired. When the observation of the splash is obtained plot the ballistic range of the target by measuring the observed deviation of the *target* from the *splash.* This is continued until we get an approximate track of the ballistic range of the target. By inspection we should be able to draw a curve through these observations such that the residual errors will be a minimum. This curve will represent the most probable track of the true ballistic range of the target, and as in our present method of tracking a moving target we should predict thereon for the correct data to be set on the gun for subsequent shots. (See Figure I.)

The idea that we should not be continually adjusting is a false idea which we have inherited from the "stationary target" problem. We must keep in mind that our purpose is not so much to *obtain* adjustment as it is to *maintain* adjustment. *The deviation of every shot has a corrective value proportional to the square of its deviation.* (Not mathematically accurate, but a close approximation for deviations not exceeding four probable errors.) These corrective values must be applied continually in order to secure the maximum benefit from the Law of Probabilities.

It is believed that the above discussion may be better understood if we consider the adjustment of fire as a method of position finding. For the purpose of illustration let us assume that the only method of position finding available were an airplane observer. This observer sends us the approximate range and azimuth of the target, also its approximate direction and speed of travel. Using a time-range board and a time azimuth board at the gun the approximate curves for the ballistic ranges and azimuths, respectively, are drawn. The gun is fired on this approximate data. The shot falling somewhere in the vicinity of the target the observer now will be able to give fairly accurate information as to the ballistic position of the target, by estimating the distance of the target from the splash, whose ballistic position is known. These values for the range and azimuth of the target are plotted on the time data boards, and constitute the first observation of the position of the target. Now if a number of shots were fired at 30 second intervals and this process repeated, within a very short period of time, the time data curves could be established so that predictions could be made thereon for effective fire, regardless of any conditions of wind, atmosphere, muzzle velocity, range table errors, orientation, or anything that might cause a variable error. The curve thus established is the resultant of all of these effects as well as the effect of travel. This curve establishes the bal-

listic travel of the target. This is a direct method of fire control and should prove very effective in maintaining adjustment as long as observation is possible. It should be noted that in this case adjustment corrections are not applied, but are absorbed in all data set on the gun. The only personnel required in this system of fire control are two time-data board operators, and an observer. The more rapid the fire delivered at the target the more effective this method becomes.

We should now consider position finding, as the term is ordinarily used, as being a means for adjusting, rather than adjusting as a means of position finding. We are not primarily concerned with the actual position of the target. Its ballistic position is what is sought. Since the actual travel of the target usually constitutes the major portion of the ballistic travel, it is very important to accurately determine the actual travel whenever possible, so that the ballistic travel may be corrected, therefore materially facilitating the problem of adjustment.

Determination of Armament Error

In every series of shots fired at a target there is an occurence of a combination of all three of the classes of errors as named above. It is impossible to ascertain these errors, but we can ascertain the resultant residuals. We know that accidental errors follow a definite law, and if the residuals obtained do not follow this law we have proof of some other class of error existing. To treat these resulting residuals as accidental errors is fundamentally wrong. For the purpose of analysis there is a very simple method whereby the constant and variable errors may be practically eliminated and a fairly accurate value for the accidental error may be obtained. This can be done by taking the differences between the corrected fall of successive shots, and using these differences, instead of the deviations of the individual shots from the center of impact, as the basis for computing the probable error. The law of probability provides that these differences between successive shots will be equal to the square root of 2, or 1.4, times the deviations of single shots from the center of impact. By obtaining the mean of these differences and dividing this by 1.4 and multiplying it by .845 we obtain a fairly accurate value for the probable accidental error developed. Where there is a large variable error introduced, and the series extends over any considerable length of time, the difference between the first and the last shot of the series should be distributed, in proportion to the time difference, between all the shots in the series.

The following is an example of this method:

EXAMPLE OF DETERMINING PROBABLE ARMAMENT ERROR

(Data used taken from actual firing. See Fig. 1)

Shot No.	1	2	3	4	5	6	7	8	9	10	Remarks
Gun No.	1	2	1	2	1	2	1	2	1	2	
Range to set-forward point	15015	15000	14930	14910	14825	14805	14670	14660	14430	14450	
Corrections applied	+250	+250	+330	+330	+285	+285	+230	+210	+ 20	+ 20	(a)
Ballistic range to splash	15265	15250	15260	15240	15110	15090	14900	14870	14450	14430	
Deviation of target from splash	+100	+ 60	−120	−170	−160	−230	−230	−210	−180	−120	(b)
Ballistic range of target	15365	15310	15140	15070	14950	14860	4670	14660	14270	14310	(c)
Time of splash	1	2	7	8	13	14	20	21	28	29	(d)
Correction for variable error	0×38	1×38	6×38	7×38	12×38	13×38	19×38	20×38	27×38	28×38	(e)
	0	+ 40	+230	+270	+460	+490	+720	+760	+1030	+1060	
Correction for calibration	0	0	0	0	0	0	0	0	0	0	(f)
Corrected ballistic range of target	15365	15350	15370	15340	15410	15350	15390	15420	15300	15370	
Range difference between successive observations	—	15	20	30	70	60	40	30	120	70	(g)

Remarks: (a) Method of adjustment used: Successive approximations.
(b) Efficiency of adjustment = 22%.
(c) $d_1 - d_{10}$ = 1055 yards.
(d) $t_1 - t_{10}$ = 28.
(e) Variable Error $= \frac{1055}{28} = 38.$
(f) Note:—37 yards difference in average ballistic range of No. 1 and No. 2 Guns due to variable error.
(g) Mean = 50 yards.

$$\frac{0.845}{\sqrt{2}} = 0.6$$

Probable Armament Error = 0.6 × 50 = 30 yards.
Probable Armament Error as shown by Battery Commander's Report = 132 yards.

It should be noted that the above method does not make use of the Center of Impact. The true center of impact has no constant value.

In re-computing the probable error of a great number of practices held in the past by the method outlined above it has been discovered that almost invariably the probable armament errors as shown in the original analysis have been too large. In most cases the constant or variable errors entering therein become plainly evident. Especially in mortar practices were variable errors encountered, in some cases reaching in magnitude to 50 yards per minute. Calibration errors were also frequent, and easily detected as constant errors.

As a result of experiments along this line the conclusion is reached that in all of our armament we have been assigning too large a value for the probable error.

It is believed that the probable range error for mortars at mid-ranges is about 30 yards, and for major caliber guns at 15,000 to 18,000 yards, it is about 50 to 75 yards.

THE FOUR STANDARD METHODS OF ADJUSTMENT

Much has already been said in criticism of the four standard methods of adjustment as used in our target practices. It is now generally conceded that they are inadequate in their application to adjustment on moving targets. However, these represent the best which we have developed thus far, and we should make use of the experience gained in their use for developing something better. With this consideration in view it is deemed pertinent to discuss a few fundamental errors which we have been permitting. For instance, the method of Successive Approximations, as modified for use with moving targets, provides that "After one shot (or salvo center of impact) has fallen in the 50 per cent zone, require two successive deviations of the same sense and both greater than one probable error before making a further correction." The key to the application of this rule is the *probable error*, yet the fact that the probable error of a "salvo center of impact" differs from the probable error of a single shot is ignored. The probable error which should be used in applying this rule to the use of a salvo of four shots should be exactly one half the probable error used with the same armament when the adjustment is by single shots, in order to secure the same results. This is a mistake that even the author of this rule makes in one of his examples of its application. In many cases this has been directly responsible for poor adjustment, but this is not so criminal as is the fact that a fundamental law has been violated.

The method of Successive Approximations as prescribed in Coast Artillery Memorandum No. 4, provides that "If after six shots adjustment has not been secured a new series of numbers

should be begun, applying the rule as before." Here, too, it appears that an error has been made. Adjustment is solely dependent upon the observations of past shots; then why should we throw away this valuable and costly experience for which we have paid the price of six shots? That these shots did not hit near the target is no reason for discarding them. As long as we know where they hit they serve their purpose. Under the circumstances they should be of even more than the ordinary value to us in the determination of the cause of such a condition.

The Trial Shot Method no doubt will always be of valuable use in the adjustment of artillery fire. However, it should be classified as a method of preparation of fire rather than as a method of adjustment.

The salvo center of impact method is always dependable for a certain degree of accuracy in any case where the ballistic travel of the target is not so great as to require a predicted correction. However, it makes full correction for accidental errors, which is wrong in principal, and its inherent error is equivalent to the dispersion of the centers of impact of the salvos used.

The Bracketing Method is a field artillery method and has no practical application to moving targets.

None of the above methods make use of the time element, a fundamental consideration.

In this connection it may be stated that the general use of the Field Probable Error as being one and one-half times the range table probable error is exceedingly arbitrary and wholly unjustified. In doing this we are admitting an error due to field conditions even larger than the armament error. If our range table probable error were 50 yards, and we combined therewith other effects which caused a probable error of 50 yards, the resultant, or field probable error would be only 70 yards. This seems to be entirely excessive.

Suggestions for Method of Adjustment

The best that may be expected from any method of adjustment is that it will interpret the law of probability to a mathematical exactness. This we should strive for. While the values we will thus determine to be the most probable values may be far from the absolutely correct values, yet we must realize that it is impossible to know these correct values, and should we use the most probable values, in the long run, our results would reach the maximum efficiency possible.

In order to interpret this law of probabilities, as applied to changing values it is essential that the time element be considered.

It is suggested that what we should attempt is a solution of this problem rather than a method of adjustment. If this problem can be solved, then every artilleryman should be required to follow this law, and the means by which this is accomplished will be of no particular importance.

It is with this hope of an ultimate solution that the following suggestions are offered.

The corrective value of any deviation is in proportion to its improbability of being an accidental error. Accidental errors as such have no corrective value. The improbability of a deviation being due to an accidental error is proportional to the square of the deviation, therefore, the comparative corrective values of a number of deviations of different magnitude are proportional to the squares of the respective deviations. This means that if a unit correction value were assigned to a deviation of one probable error, a deviation of two probable errors would have a corrective value of four, a deviation of three probable errors a corrective value of nine, of four probable errors, a corrective value of sixteen, etc.

This law of corrective values should be a fundamental principal of any method of adjustment. Every deviation, no matter how small, affects the result of the final determination of the most probable value. There is no dividing line between small deviations and large deviations, whereby they may receive different treatment. As a matter of fact in some of the present methods of adjustment we make an arbitrary division of these deviations into two classes, namely, those indicating a correction due, and those indicating proper adjustment. Treatment such as this is purely arbitrary and is no doubt responsible for the general use of the term "arbitrary correction" as applied to adjustment correction in artillery fire.

Knowing this law of corrective values, how may we apply it? A number of difficult methods may be employed varying in degree of accuracy and practicability. A logarithmic slide rule may be used, whereby the deviations may be promptly converted into corrective values. This slide rule may also be provided with means of adding these corrective values algebraically, thereby keeping a record of all cumulative corrective values which have not previously been applied.

A simpler method would be to give each deviation a corrective value equal to the amount of its deviation in excess of one probable error. This method very closely approximates the correct law, and is very easy of application. (See Figure 2.)

In order to correct for variable errors there must be an adjustment of values against time. The adjustment correction for each shot must be predicted. This problem is identical to our prob-

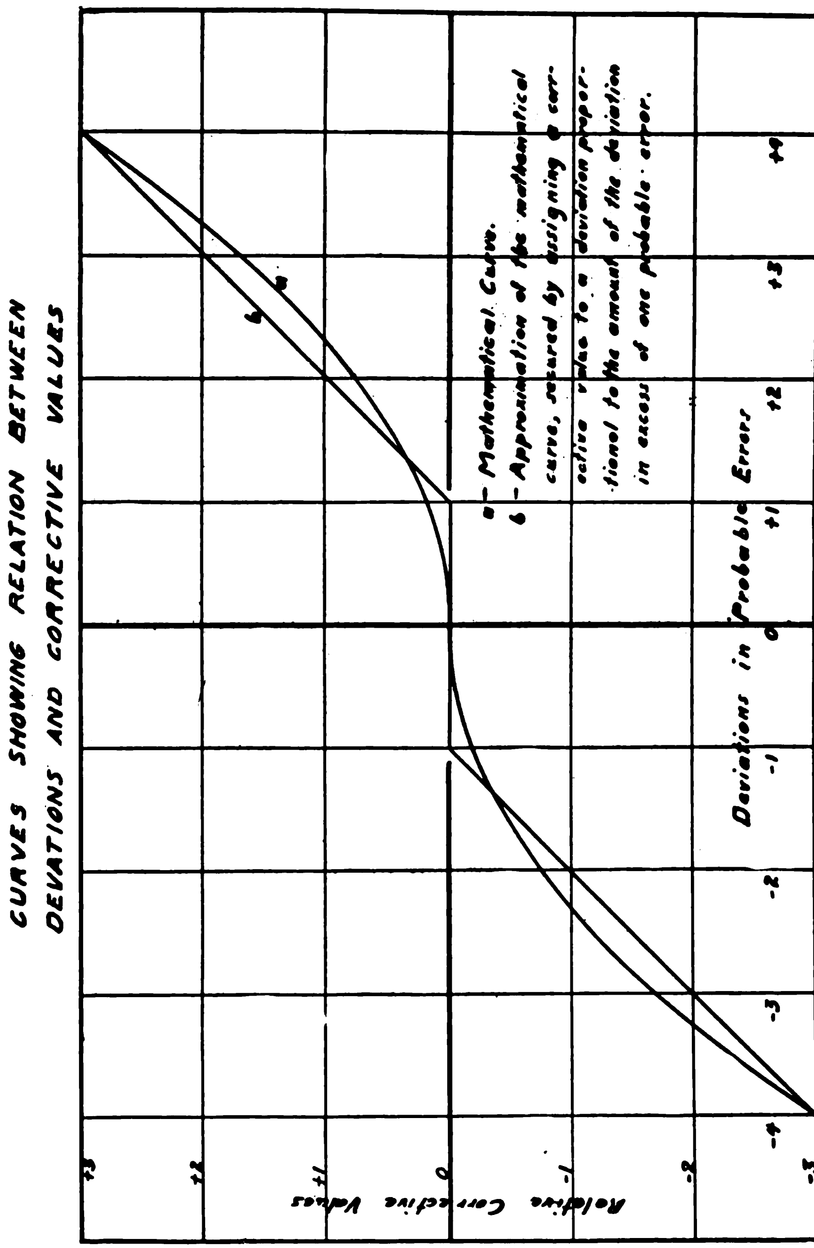

CURVES SHOWING RELATION BETWEEN
DEVATIONS AND CORRECTIVE VALUES
a
b
a—Mathematical Curve.
b—Approximation of the mathematical curve, secured by assigning a corrective value to a deviation proportional to the amount of the deviation in excess of one probable error.
Deviations in Probable Errors
-4
-3
-2
-1
0
+1
+2
+3
+4
Relative Corrective Values
+3
+2
+1
0
-1
-2
-3

FIG. 2

lem of obtaining the set forward point, and our method which we use for this is a satisfactory interpretation of the law of probability.

The following is suggested as a basis of experimentation for the possible development of a practical solution of this problem:

1. Two classes of corrections must be applied after each shot:
   (a) Flat corrections (for constant error.)
   (b) Travel corrections (for variable errors.)
2. Flat corrections must be in proportion to the square of the deviations.
3. Travel corrections must be in proportion to the algebraic sum of all previous flat corrections and should be applied on uniform time intervals, whether or not a shot be fired.
4. The constant factors which reduce these proportional values as stated above to absolute values may be an empirical fraction which may be experimentally deduced.
5. When only sensings are determined assign values for deviations as follows:

For a sensing which contradicts the next preceding sensing assign a value of one probable error, for two successive deviations of the same sensing assign a value of two probable errors to the second, for three successive deviations of the same sensing assign a value of three probable errors to the third, for four successive deviations of the same sensing assign a value of four probable errors to the fourth, etc. (See Figure 3.)

From an inspection of Figure 1, the question naturally arises as to the necessity of any method of adjustment, other than a plot of the ballistic range of the target. This method is recommended for its simplicity and practicability.

With such a picture as is presented in this illustration before him no battery commander would ever permit such poor adjustment as was maintained in this problem (Fig. 1). Had the battery fired on every bell the track of the ballistic range of the target would have been still more obvious.

It is believed that if no method of adjustment were prescribed for the battery commander, and the efficiency rating of his practice were determined mainly on a percentage basis, using the relation of the mean armament error to the mean deviation actually obtained, that within a short time an efficient method of adjustment would evolve.

Observation and Spotting

Adjustment of fire is based solely on observation of fire. No matter what method of adjustment is used, its accuracy is dependent on the accuracy of observation.

EXAMPLE OF METHOD OF ADJUSTMENT

Rule:- 1. After preparation of Fire, continue at maximum rate.
2. Make flat correction on each reported deviation equal to ½ the amount of the deviation in excess of one probable error.
3. Make an additonal Ballistic Travel correction on each shot fired equal to ½ the algebraic sum of all previous flat corrections.
4. Apply corrections thus determined on the next shot fired.

Time of Firing	Hit Bag Dev. P.E. = 40 yds	Range Table Error (Variable)	Dev. obtained had no Cor. been made	Total Correction used	Actual Deviation		Flat cor. = ½ Dev. in excess of one P.E.	Travel cor. = ½ algebraic sum of previous flat cor.	Total new Correction	Splash No.
1	+ 60	+ 100	+ 160	- 100	+ 60		In	the	air	
2	+ 20	+ 120	+ 140	- 100	+ 40		In	the	air	
3	+ 60	+ 140	+ 200	- 115	+ 85		- 10	- 5	- 15	1
4	- 30	+ 160	+ 130	- 120	+ 10		0	- 5	- 5	2
5	0	+ 180	+ 180	- 155	+ 25		- 20	- 15	- 35	3
6	- 120	+ 200	+ 80	- 170	- 90		0	- 15	- 15	4
7	- 20	+ 220	+ 200	- 185	+ 15		0	- 15	- 15	5
8	+ 30	+ 240	+ 270	- 165	+ 105		+ 25	- 5	+ 20	6
9	- 20	+ 260	+ 240	- 170	+ 70		0	- 5	- 5	7
10	+ 40	+ 280	+ 320	- 220	+ 100		- 30	- 20	- 50	8
11	- 60	+ 300	+ 240	- 260	- 20		- 15	- 25	- 40	9
12	+ 80	+ 320	+ 400	- 330	+ 70		- 30	- 40	- .70	10
13							0	- 40	- 40	11
14	mean =				mean =		- 15	- 45	- 60	12
15	45 yds.	← Efficiency = 80% →			57 yds.					

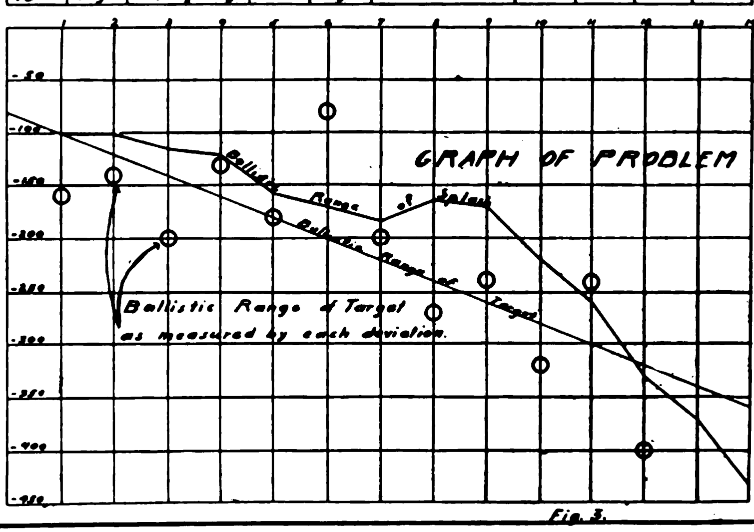


FIG. 3

Whenever observation is impossible we have to rely solely upon computed ballistic data in fire for effect. Our gunnery instructors use this possible condition in order to emphasize the importance of extreme accuracy in the computation of firing data. Let us consider the possibility of this condition in the case of naval targets. If observation on a moving target is impossible how are we to determine its position? Will we be able to compute any ballistic data when we are unable to determine its map data? In the case of land firings this consideration is important, for we can compute our data from the map position of the target, and we will be able to fire, with a fair probability of obtaining hits, without observation. There is only a bare possibility that we may be able to track a target and not be able to observe the splashes, while a great many situations may occur especially in combat, where we will be able to observe splashes, but will be unable to track the target.

Under the most favorable conditions of combat the horizontal base system of position finding is unwieldy and of doubtful value. When a fleet of any size is maneuvering, as it would do in combat, changing formations and relative positions, it is practically impossible to get two observers, who are widely separated, on the same target. Under the most probable conditions of combat it is believed that this system of position finding will prove a failure. Smoke screens may and very probably will preclude the use of any terrestrial observation, except from some possible vantage point on the flank. Under such conditions our present system of accurately calculating ballistic data will be of little use to us. Our fire control will depend upon observations by airplane, baloon, sound-ranging, or terrestrial observation from such positions as the conditions permit. Accurate measurements of the position of the target will be impossible, but its ballistic position may be determined with a fair degree of accuracy by an estimate of the deviation of the splash. The facilities for spotting are much greater than the facilities for map ranging. At present the relative importance of the three phases of fire control, as reflected in the training of the personnel are: 1st, position finding; 2nd, adjustment; and 3rd, spotting. It is suggested that this may well be reversed. Adjustment is the end sought, and spotting is a prerequisite, while position finding only facilitates adjustment.

It is believed that spotting may be greatly facilitated by having the splashes occur at uniform time intervals. For example, let us suppose a case where six major caliber guns are firing at one or more naval targets, each firing at intervals of one minute. If the splashes of these guns, numbering from 1 to 6, should occur ten seconds apart, at time 10″, 20″, 30″, 40″, 50″, and 60″ respective-

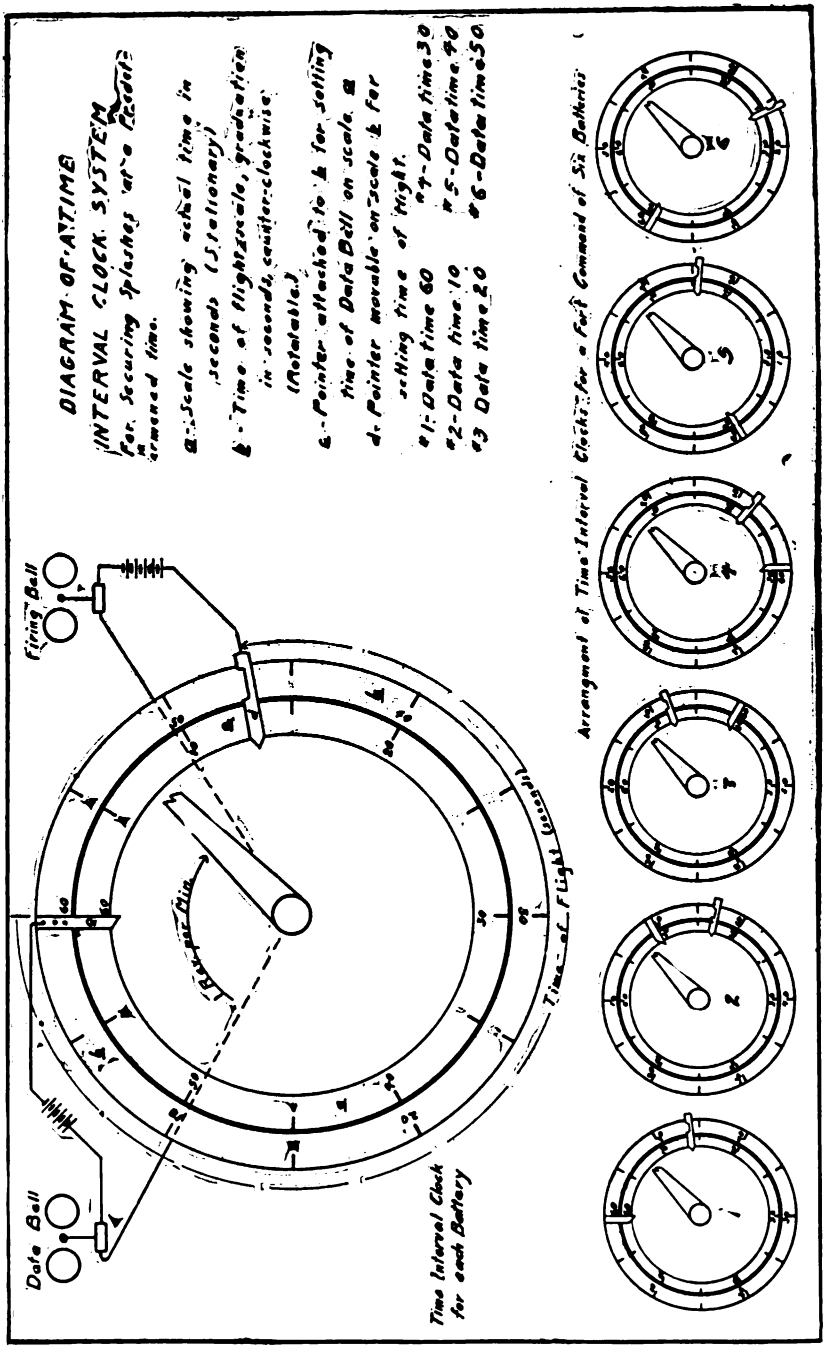


DIAGRAM OF A TIME
INTERVAL CLOCK SYSTEM
For Securing Splashes at a Predetermined time.
a - Scale showing actual time in seconds (Stationary)
b - Time of flight scale, graduation in seconds, counter-clockwise (Rotatable.)
c - Pointer attached to b for setting time of Data Bell on scale a
d - Pointer movable on scale b for setting time of flight.
#1 - Data time 60
#2 - Data time 10
#3 Data time 20
#4 - Data time 30
#5 - Data time 40
#6 - Data time 50
Data Bell
Firing Bell
Rev. per Min.
Time of Flight (seconds)
Time Interval Clock for each Battery
Arrangement of Time Interval Clocks for a Fort Command of Six Batteries

FIG. 4

ly, then one observer would be able to spot for the entire six guns. This may be six batteries firing in salvos, either simultaneously or a few seconds apart. This can be done in a very simple manner. All that is necessary to adopt a setforward point of uniform travel time, and fire the gun at the time indicated by a time of flight table. This system is believed to be both simple and more accurate than the present system of using the travel during time of flight in the determination of the set forward point. This feature of firing the gun, so as to secure a splash at a predetermined time, may be easily taken care of mechanically by having a firing bell at the gun connected electrically to a clock in the plotting room on which the time of flight may be continually set. The gun may be fired on the bell. (See Figure 4.)

It would be a comparatively simple matter to have the time interval apparatus for a fort or coast defense so arranged that each battery or fire command would have a separate data bell, which would be a permanent characteristic of that particular battery or fire command. Six firing units could be taken care of in this manner, with a difference in splash of 10 seconds each, or four units with a splash difference of 15 seconds, this being based on the rate of fire of one shot per gun per minute.

Unless use is made of some such system as suggested above, spotting in combat will be a difficult procedure, and adjustment, as a consequence, ineffective.

A favorable physical impression made upon associates and those with whom one has business dealings increases their confidence and their possessor's earnings. An erect carriage, courteous manner, poise, neatness of dress, and a generally excellent appearance have money values of their own in their effect upon others, but even more important psychological results in the individual himself. They give him self-respect and self-confidence. He approaches his problems with more assurance and fewer doubts in his own ability.
—*John W. Weeks.*

The Decision to Defend Kut-el-Amarah

By MAJOR E. W. C. SANDES, *D. S. O., M. C., R. E.*

[REPRINTED BY PERMISSION OF *Royal Engineers Journal*]

A SMALL boat, with a picked crew and an expert steersman, once put to sea in fine but threatening weather. She was safely launched, and rode undamaged through several lines of breakers, being handled with daring and skill, so that at last only one line foamed and spouted ahead of her. But the tide was already on the turn, and a storm was brewing, so the steersman hesitated to make the attempt which would bring him to the open sea. In the end he made a dash for the last line of breakers, hoping to get through at the first attempt and relying on the proved courage and grit of his men, but the waves checked the boat, and the incoming tide gradually brought her to a standstill. The exhausted crew battled furiously to make headway. Two men were swept overboard, and the boat was almost swamped and began to leak, so the steersman decided to make for harbor. He managed to turn between two waves and ran for home. The storm roared behind him and his boat was sinking, but he saw a sandbank and grounded her under its lee, intending to rest his crew and repair the boat while the storm lasted, and then to try again. He forgot the tide. It rose slowly, and finally engulfed him and his men within sight of their friends on shore, many of whom perished in attempts to reach the castaways.

This allegory represents, in some ways, the case of the late General Sir Charles Townshend and his force in the attempt to capture Baghdad in 1916, and his retreat to, and surrender at, Kut-el-Amarah. The 6th Indian Division was a highly trained force, and its commander a skilful strategist and tactician who had the complete confidence of his men. The boat was launched at Basra, she forced a passage through the breakers at Kurna and again at Kut, and her commander hesitated before the waves below Baghdad but decided to make the attempt. The tide of Turkish reinforcements from the north checked his small craft, and, with a reduced and exhausted crew, he managed to turn his leaking boat and reach the island of Kut. There the tide of the enemy gradually overwhelmed him within a few miles of the relief force which battled so desperately to reach him through the stormy seas which separated

them. The allegory fails in one respect, in that General Townshend's idea in remaining in Kut was not only to rest and save his men, but to check the advancing foe; but, just as King Canute found that a tide cannot be checked, so Townshend found that the enemy encircled him and soon passed far beyond the limits which he had anticipated when he halted.

* * * * * * * * * *

It was in November, 1915, that the 6th Indian Division, with the 30th Brigade and a few other attached troops, gained a partial success over the Turks at Ctesiphon. The Turks, however, were strongly reinforced during and after the fight, and the British force, under Townshend, suffered such casualties that it was compelled to retire a distance of 100 miles to Kut-el-Amarah, pursued by large bodies of the enemy which had arrived from Erzerum and elsewhere. General Townshend's force of about 10,000 men, including roughly 6000 infantry, was harassed in the retreat by the advanced guard of the Turkish army under Nur-ed-din Pasha, and that advanced guard was superior to it in numbers, and even in armament. The Turkish force was composed of the best Anatolian troops, elated by the retreat of the hitherto victorious British, and guided by the advice and experience of a large staff of German officers. The British, nevertheless, defeated the Turkish advance guard at Ummal Tabul during the retreat, and thus enabled most of their shipping to reach Kut. This action checked the enemy sufficiently to give Townshend a few days at Kut, prior to the arrival of the enemy, in which to begin to entrench.

The troops, however, were terribly exhausted—so exhausted that, on reaching Kut on the 3rd of December, 1915, they were quite incapable of constructing in a few days a complete system of trenches and redoubts for defense against the advancing hordes of the Turks. Rest was imperative, and the question was whether rest could be obtained. It was partly the necessity for rest and reorganization for his retreating force which caused General Townshend to halt at Kut on the 3rd of December, 1915. He had not decided till that date, whether he would remain in Kut or not. To quote his own words: "It was practically impossible for me to retire from Kut. So exhausted were my troops that they lay down and could do nothing but eat and sleep for two days." The human factor, then, became an important one in the situation, as it does so often in actual warfare, and the halt of the British force enabled the Turks to regain touch with it after it had outdistanced their pursuing troops in a series of forced marches.

I have given a brief *résumé* of the operations leading up to General Townshend's arrival in Kut from Ctesiphon as it is neces-

sary to visualize clearly the circumstances under which he was forced to decide whether he would halt at Kut and subsequently continue his retreat, or whether he would remain in Kut and defend it against the advancing enemy. I think that any officer who took part in the retreat will agree that, whether Kut was held or not, a *halt* at Kut was imperative. The marvel is that the British force ever reached Kut. I do not think that it would have done so if the pursuit had been pushed with vigor and in a scientific and efficient manner. Fortunately, the Turks still had a wholesome respect for our offensive powers, and the Turkish leaders made several gross tactical blunders which prevented our retreat from being cut off.

Field Service Regulations, Volume II, Chapter XI, which deals with the subject of "Defense," gives the following axiom: "When a commander decides to adopt a defensive rôle, the manner in which he will be able to carry out his plan will depend largely upon the time available for preparing his defensive organization, and upon the general situation in the theatre of war. Thus circumstances may only allow of a hastily organized defense, or they may permit of the deliberate occupation of a well-organized defensive position *commanding a line of advance which is essential to the enemy.*" The line of the River Tigris was essential to the advance of the Turks, though the Kut peninsula was not a well-organized defensive position. The fact that the line of the Tigris was essential to the enemy, if he desired to advance any considerable distance into Lower Mesopotamia, was the main point which decided General Townshend to establish himself at Kut. By remaining there until relieved he also denied to the Turks the use of the Shatt-al-Hai Channel leading to Nasariyeh, which might have enabled them to advance on Basra or Amarah, by a flank attack from the west, when that channel filled with water early in January.

On the 3rd of December, 1915, General Townshend decided not only to halt at Kut but also to *remain* in Kut, and he informed the Army Commander, General Sir John Nixon, to that effect. So momentous a decision, in a minor theatre of war, has rarely been taken by a subordinate officer. The responsibility of making that decision was left to General Townshend by the Army Commander, who, however, on the 4th of December, gave him seven arguments in favor of defending Kut and notified his approval of the decision. In his own opinion General Townshend was forced, in the first instance, to decide between the possible loss of his Division and the probable loss of Mesopotamia. Can one wonder that, maintaining the tradition of offensive action so dear to the British Army, he decided to fight and to risk the loss of his force rather than to retire and perhaps lose the country which he had conquered? That he did

actually lose his force, and that more than 20,000 men were sacrificed in vain endeavors to save that force, was decreed by fate; yet, if it was a mistake to defend Kut, his action should not be judged without a full consideration of the circumstances which induced him to make his decision. Let us consider those circumstances.

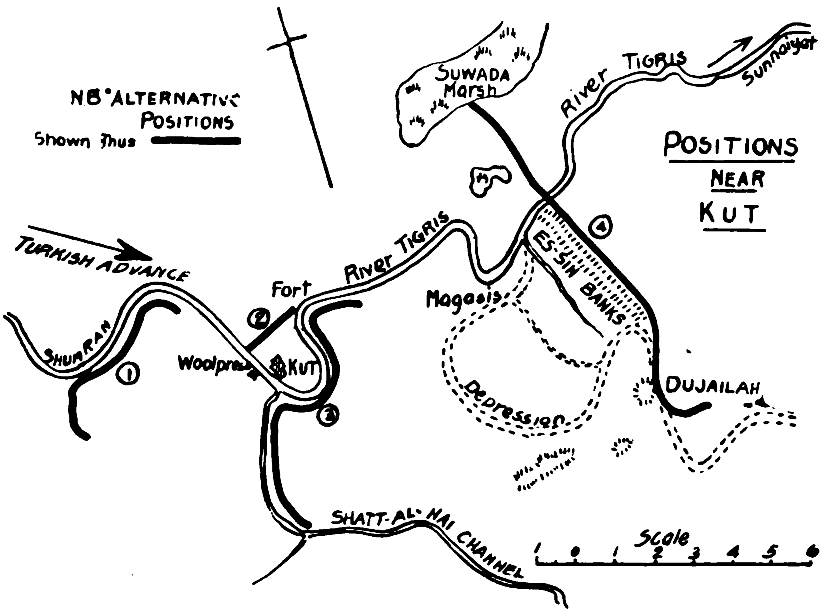
Firstly, the British force was exhausted on reaching Kut. It could retreat no further, though in a few days it might be able to do so. It was accordingly tied to Kut for, say, three or four days.

Secondly, if it remained in Kut and fortified that locality, it blocked not only the River Tigris to the enemy's shipping, but would also deny the Shatt-al-Hai channel to that shipping when the channel became flooded. The Turks had only five ships upstream of Kut, and they depended on those ships for their ammunition and equipment, and to some extent for their reinforcements and food, though they could live on the land as no British force could. They could not carry the war far into Lower Mesopotamia if Kut was held. They had not sufficient land transport to maintain a large army advancing further and further into a pestilential region, even though the Arabs of that region might be friendly while success attended the Turkish advance. While Kut was held, the Turks were tied to it by a string of a certain length—not by a piece of elastic. If too much strain came on the string it would break; it would not stretch.

Again, General Townshend was fully aware that reinforcements were only dribbling into Mesopotamia and were a long way off. He was informed on the 5th of December, two days after his arrival, that he might count on being relieved in two months, and that a force was being concentrated as soon as possible at Amarah, more than 100 miles away to the southeast, with a covering force of only one brigade at Ali-al-Gharbi, 30 miles to the east. Note the words "as soon as possible." Townshend could not hope to be *adequately* reinforced at Ali-al-Gharbi if he retreated from Kut. He might meet reinforcements before he reached Amarah. But could he reach Amarah, harassed by thousands of Arabs, and possibly pursued in time by large bodies of the best Turkish troops? It seemed problematical at the time. Those who had seen the force enter Kut on the 3rd of December might not even have conceded that it was problematical. General Townshend decided that his reinforcements were not sufficiently near him to warrant a further long retreat in an endeavor to meet them. He decided to wait for their close approach and then to cooperate with them. He was exhausted. They would be comparatively fresh.

The British force was small—about 7000 infantry. Supposing that a prolonged retreat was impossible, the question arose as to

whether this small force could take up a position where it could reasonably expect to withstand the Turkish onslaught for a time, preparatory to further retirement towards its reinforcements. It had very few machine guns, and little modern artillery except for three batteries of 18-pounders; therefore it could not occupy an extended line. It had not much barbed wire, and no bombs. For defense it had chiefly to rely on rifle fire. Was there a position of, say, not more than two miles in length where its flanks would be secure? Yes. A position across the neck of land forming the loop of the river Tigris containing Kut would fulfill those conditions. It has been said that General Townshend should have retired to the



Es-Sin position, a line of embankment some seven miles below Kut town, where trenches existed. That position was six miles long on the right bank of the Tigris and three miles long on the left bank. The trenches also faced the wrong way. Possibly an Army Corps with plentiful machine guns might have been able to hold Es-Sin and to protect its flanks from envelopment, but certainly not a force of four weak brigades. Supposing that General Townshend had retired to the Es-Sin position, how long could he have maintained his force there? There were no supplies in the position. There was no transport to bring sufficient quantities of provisions and ammunition from Kut to the position if it was to be held for a week or more. There was no water at Es-Sin except near the river. Amarah was the nearest point from which supplies could be obtained from

downstream. General Townshend subsequently wrote as follows: "Had I taken up my position at Es-Sin, I should have been enveloped and overwhelmed in a decisive battle in three or four days' time." Was there, then, any other position which the British force might have occupied for a time preparatory to retirement? If it could have crossed to the right bank of the Tigris it might have taken up a position on that bank near Shumran, four miles above Kut, placing the Tigris between it and the enemy owing to a bend in the river, and with its left flank only exposed to envelopment if the Turks crossed to the right bank. This they could not do at once as they had no bridge. On the other hand, we had a Bridging Train and I think that I could have constructed a bridge for the crossing of our force, though not at Kut itself. This Shumran position was recommended by the Brigadier-General, R. E., and a further retirement could have been executed from it to the Shatt-al-Hai channel which could have been held temporarily as a rear position; but the occupation of the Shumran position would have meant the abandonment of the left bank of the Tigris and of Kut town with all its supplies, and a subsequent retreat under fire from Kut on the flank. Also, we could not have taken sufficient supplies to the position for more than a few days.

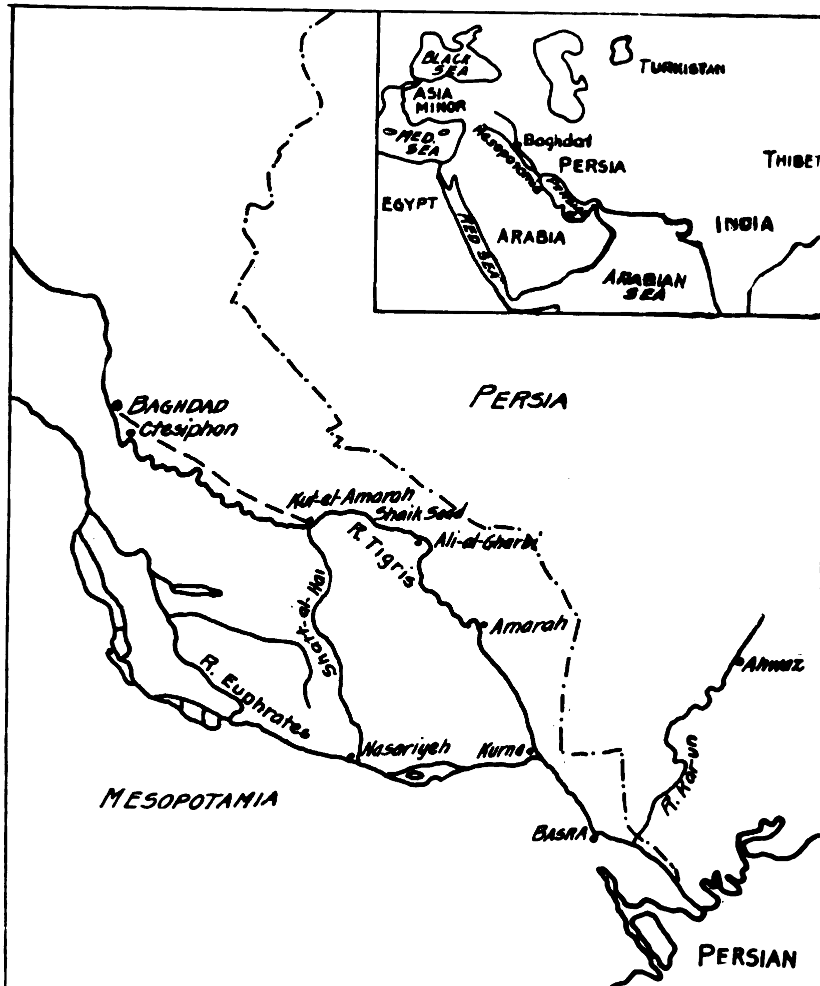
General Townshend decided that the only locality in which he could put up a defense, and also maintain his force for a reasonable time, was in the loop of Kut. Here he was secure. His flanks were safe, his rear was safe, he could hold his front line against determined attacks, and, as *Field Service Regulations* put it, "He commanded a line of advance essential to the enemy." He has been criticized for adopting an attitude of passive defense. That was not his intention. To quote his own words once more: "I intended to use my entrenched camp as a pivot of maneuver, when, by improvising a bridge and a fortified bridgehead, I should be able to throw the principal mass of my force on to either bank of the Tigris in an offensive against an isolated fraction of the enemy. Had my troops been able to work and get the bridge across the Tigris opposite the town of Kut, I should have been able to make an *active* defense." General Townshend was well aware of the usual fate of a force which shuts itself into an entrenched camp for a passive defense. The outstanding example of Marshal Bazaine at Metz in the Franco-Prussian war was ever in his mind. But his plans for an active defense were stultified by a lack of engineering information, and in this respect I should like to indicate how important is the question of the *liaison* of the General Staff with the engineers. A bridge across the Tigris opposite Kut was impossible. I commanded the Bridging Train and had lost most of my boats and all my pontoons

during the retreat from Ctesiphon when we were chased by cavalry and had no escort. The river was 600 yards wide opposite Kut town, and I could have told the G. O. C. at once that the maximum length of bridge which I could construct, given several days to do so, was, roughly, 300 yards. If General Townshend had been aware that his system of active defense was thus rendered impossible, he might have altered his decision to remain in the loop of Kut. But he apparently assumed also that he could prevent the Turks from bombarding any bridge with artillery. A large bridge cannot be maintained for more than a few days under hostile artillery fire without great reserves of material and boats, and we had no such reserves of a suitable nature. If a bridge had been constructed it would infallibly have been destroyed by the Turkish artillery or mines, or captured by a determined assault, and the defense of Kut would then have become passive, at least, as regards the right bank of the Tigris. On the Kut side, *i.e.*, the left bank, the Turks quickly surrounded our entrenched system with three lines of trenches, well wired, strengthened by redoubts, and supported by artillery. Sorties in force on this bank soon became difficult, and later impossible, owing to the flooded ground. Again, it would seem certain that the intended active defense was doomed to develop into a passive one. However, the Kut loop was considered to be the only possible defensive locality, and it was occupied and strengthened as far as our men were able. The land front to be defended was one and one-fourth miles long and the river protected the flanks and rear. The Turks were in front and the river behind; in fact, we were between the devil and the deep sea.

Another point influencing the decision to defend Kut was that it was our advanced base for supplies, stores and ammunition. These had been accumulated for weeks. The shipping downstream was fully employed in bringing up reinforcements and could bring no more stores. The enemy was naturally short of supplies and would benefit greatly by the recapture of Kut. It was therefore of great importance to preserve our supplies and also our store of ammunition. There was not sufficient transport to remove the bulk of the supplies and stores if we evacuated Kut. On the other hand, the supplies would enable us to withstand a siege of some duration—at any rate, as long a siege as then seemed likely.

However undesirable they may be, political considerations are apt to influence military operations. Kut was no exception. The Political Department was emphatic regarding the bad political effect which would be produced throughout Mesopotamia by a further retirement downstream. The Political Officer pointed out that in such an event our half-hearted Arab allies would go over to the

Turks, the country would rise against us, and our prestige would be gone. Also, the failure of the Gallipoli campaign, and the situation in Persia and Afghanistan, made it advisable to avoid the bad



effect of a lengthy retirement towards Amarah. Again, when General Townshend had decided to remain in Kut and wished to evacuate all the 6000 Arabs in the town, he was advised politically that the death of the Arab women and children in the desert, which would

probably result from this evacuation, would be a cause of renewed hatred against us, and so most of the Arabs were allowed to remain in Kut where they did little work and ate a vast amount of food. The necessity of maintaining British prestige in Mesopotamia thus influenced General Townshend in reaching his decision to retire no further than Kut, and certainly shortened the period of resistance of which the garrison was capable when surrounded by the Turks.

The Russians under General Baratoff were demonstrating towards Baghdad from Persia, and it was advisable to cooperate with them. By holding a large Turkish force at Kut the British assisted their allies from Russia. The Russian force, however, had little driving power. It consisted mainly of irregular cavalry with only a few guns. When the Kut position was occupied the limitations of the Russian offensive were scarcely understood.

A last consideration, which doubtless influenced General Townshend in his decision to hold Kut, was the necessity of allowing the increasing force downstream as much freedom of action as possible, *i.e.*, space in which to maneuver in country suitable for maneuver and well above the swamps at Amarah. The force downstream could then concentrate unhindered and maneuver freely for offensive action. It would have the initiative.

I have tried to show what were the considerations which induced General Townshend to hold Kut, but there are two sides to every question and many people have disagreed with his decision. He had eluded the Turks by a skilful rear guard action and a rapid retreat, and, though he had not been reinforced to any extent, he then allowed himself to be overtaken and surrounded by greatly superior forces. Again, on his own admission, he underestimated the capability of the garrison to hold out. This was caused partly by incomplete reports of the amount of supplies available in the town (a very difficult matter to estimate), and partly, perhaps, by too modest an opinion of the ability of regular troops to exist on reduced rations. But it was due, also, to his estimate of the condition of his troops. He considered that they were too exhausted to withstand the physical and mental strain of a heavy assault or a long siege. The Indian regiments had lost most of their British officers, and the casualties early in the siege were heavy. Most of the General Officers in Kut considered that a really determined assault by the Turks within the first six weeks would have succeeded if pressed home regardless of losses. The Turks actually assaulted on the 10th and 12th of December, 1915, and, on Christmas Eve, they almost captured Kut, but by that time we had some trenches, and the assault was not made in sufficient strength. Anyhow, the underestimation of the garrison's ability to resist the Turks was unfor-

tunate for the relief force, which attempted attacks without adequate preparation in order to save Kut. The repeated failures of the small relief force gave time for the Tigris to rise to flood level and thus to render the relief practically an impossibility. General Townshend, when he decided to remain in Kut, never contemplated a siege of such length as to last till the flood season in March, and he was supported in this estimate of the probable duration of the siege by the receipt of a telegram from the Army Commander in which the latter stated that two months might be considered the outside limit before a general move forward would be made by the relief force. General Townshend stated in his book, written after the war, that he did not realize at first that the Turks were being directed by a German staff, and he was consequently surprised at their initiative. The unbroken series of successes of the 6th Indian Division had greatly impressed the population of Iraq and also the Turks themselves, and Townshend considered that the Arabs would exaggerate, in their reports to the Turks, the numbers of reinforcements for the relief force and that the Turks would, in consequence, hesitate to advance much beyond Kut. Events proved that he was mistaken. The Germans clearly realized the situation and sent the Turks to occupy positions as far downstream below Kut as their overland transport would admit. The Turks were soon organized in depth below Kut, and that fact, aided by the floods, gradually brought the relief force to a standstill and finally led to the surrender of the Kut garrison from starvation.

General Sir Charles Townshend was a most capable commander in the field; he had the complete confidence of all ranks during the campaign preceding the siege; he was a keen student of military history and a man of remarkable character; but he was broken by the failure of the attempt to capture Baghdad—one of the most desperate ventures in military history—he was crushed by the change in his luck, by illness, and by the collapse of his hopes. A commander's reputation must depend to some extent on his success. Townshend never failed till he attempted the impossible at Ctesiphone. As the man most conversant with the difficulties of the situation, should he have refused to advance on Baghdad? It is not my business to offer an opinion on this question. But in war there is always the chance that the unexpected may happen, and Townshend, an optimist and born, apparently, under a lucky star, took the chance. He made a magnificent fight, but was overwhelmed. He was forced to retreat, and yet, in retreating he dealt the enemy a shrewd blow at Ummal-Tabul. He longed to find a position in which he could stop his retreat—a movement so repugnant to an ambitious commander who had always been victorious. He reached Kut. He

thought he could soon resume the offensive, or at least carry on an active defense and thus retrieve the prestige of his force. He decided to remain. He paid for that decision as a prisoner in Turkey, and a large part of his force paid for it with their lives.

The decision to defend Kut exemplifies the variety and number of the factors which the commander of a force may have to consider, and the extreme difficulty in which he may be placed. Military opinion now appears to incline to the idea that whatever loss of stores, ammunition, prestige, or men, was involved, Townshend should not have defended Kut, and that, though he might have halted in Kut for a few days to rest and reorganize his force, he should then have crossed the river and retreated on Ali-al-Gharbi. It was unfortunate that the old Turkish bridge below Kut was dismantled before he arrived from Ctesiphon. It occupied the best and only proper bridge site from an engineering point of view, and it could have been covered and defended till the British force crossed the river. It could then have been destroyed. No bridge which I could make with my remnants of boats after the retreat, could have enabled a whole division to cross the Tigris. In his retreat towards Amarah to meet his reinforcements, General Townshend would have been greatly harassed by Arabs, but he would have had the Tigris between him and the bulk of the Turkish army until the Turks could construct a bridge, and he would then have had a long start. He might have lost 3,000 men from exhaustion in this retreat, but by staying in Kut he caused, directly or indirectly, the loss of nearly 30,000 men. It is easy to be wise after the event. I think, however, that our force would have been capable of resuming the retreat as far as Ali-al-Gharbi, or even Amarah, after three days' rest in Kut, and in the retreat the 6th Cavalry Brigade and the artillery could have held off the Arabs and the Turkish calvary. Amarah held considerable quantities of supplies and ammunition. It was only about 280 miles by river from Basra, the main base, so that reinforcements could reach it with moderate speed. It seems probable that we could have reached Amarah in ten days from Kut, before the Turks could have bridged the Tigres and overhauled us. Our shipping, with the most essential supplies and our sick and wounded, could have gone with us in the retreat as it did from Ctesiphon. At Amarah the force would have covered Basra and the valuable oilfields at Ahwaz, and we should have been nearer to our base, and the enemy further from his.

The garrison of Kut, which was really a covering force for the concentration of the British army gradually assembling in Lower Mesopotamia, failed to fulfil its proper role for the following reasons:—

(i) Its use as a covering force was neutralized, as its action was to some extent ineffective and it was immobile.

(ii) It did not, except at first, engage a greater hostile force than itself, though it prevented the advance of a greater force beyond Shaik Saad, 20 miles downstream.

(iii) It could not rejoin the main body, or be reinforced without the risk of the defeat of those reinforcements in detail.

(iv) It risked destruction without compensating advantages to the army as a whole.

The Army Commander left to General Townshend, the commander of a detachment, the decision as to whether that detachment should remain at Kut as a covering body, or rejoin the main army. The Army Commander was the officer with whom rested the strategical conduct of the campaign. On him depended the arrangements for the concentration of his army for the offensive. On him devolved the duty of securing space for that concentration. He was a keen and capable soldier, his scheme for the capture of Baghdad had failed, and he had great faith in the ability and judgment of General Townshend. Was it, or was it not, his duty to decide whether a covering force at Kut was essential?

In conclusion I may say that my object in writing on such a very controversial subject is that it illustrates clearly the complexity of modern warfare in which a commander has so often to make a rapid decision of vital importance when swayed by many conflicting considerations. All honour to him who, under such circumstances, is capable of a rapid decision, even though fate decrees that it should lead to disaster, but happy is he whose decision leads his troops eventually to victory.

We have enlarged our freedom, we have strengthened our independence. We have been, and propose to be, more and more American. We believe that we can best serve our own country and most successfully discharge our obligations to humanity by continuing to be openly and candidly, intensely and scrupulously, American. If we have any heritage it has been that. If we have any destiny, we have found it in that direction.
—*Calvin Coolidge.*

EDITORIALS

The U. S. S. Saratoga

THE Saratoga is the largest, most powerfully engined, and fastest large ship ever constructed in this country. This vessel, recently launched from the yards of the New York Shipbuilding Corporation, in Camden, New Jersey, is the latest word in aircraft carriers. The Battle cruiser Hood is Great Britian's largest ship of war, but the Saratoga's 180,000 horse power, 890 feet of over-all length, and 33.5 knots of designed speed are all in excess of those of the Hood. The horse power of the more modern battle ships is approximately 35,000 but such vessels have a maximum speed of only 21 to 22 knots. Complete with all equipment the Saratoga will cost $45,000.000.00

As a result of the Washington Conference for the Limitation of Naval Armament, the United States is limited to 135,000 tons of aircraft carriers, Great Britian to a like amount, and Japan, France and Italy to lesser amounts. The Saratoga was one of six battle cruisers authorized for construction prior to this conference, but as a result of it four of these were ordered scrapped. The Saratoga and her sister ship the Lexington, however, escaped this fate and are being converted into aircraft carriers.

It is interesting to attempt to visualize the part such vessels may play in future wars. It is understood the Saratoga has a carrying capacity of seventy-two planes, about thirty of which are to be of the bombing type; most of the others no doubt being combat planes used to convoy the bombers when operating offensively and to protect their own fleet when being attacked. With her great speed the Saratoga, accompanied by cruisers and destroyers, would be able to approach an enemy coast in a minimum of time, launch its planes and drop bombs upon vital areas, and make a quick get away. However, the risk involved and the temporary weakening of the main fleet would hardly seem to compensate for the small gain to be obtained from the dropping of thirty large bombs or a larger number of small ones on enemy utilities. It is reasonable to suppose the

Saratoga and vessels of her type will be maintained with the fleet as essential adjuncts thereto for bombing operations against the enemy's first line ships and for the defense of the fleet itself.

The only other aircraft carrier of the United States is the Langley, a converted collier with a speed of approximately fifteen knots. Such a speed precludes its use with the fleet, so when funds are available for the completing of the aircraft carrier program it undoubtedly will have to give place to a vessel of a more modern type. With four ships of the type of the Saratoga, the United States will have her authorized allowance of aircraft carriers. Great Britian has adopted a different policy, and has constructed vessels of smaller tonnage. Her aircraft carriers already built or under construction at the present time are the Hermes, Eagle, Argus, Courageous, Glorious and Furious, with a total tonnage of approximately 89,000. Others remain to be built. Of these the first three have a speed equal to that of first line ships, but the last three, with their speed of 31 knots, permit their use with cruisers and destroyers. As aircraft carriers do not carry sufficient armor to stand the pounding battle ships must expect to receive in a naval engagement, it is probable the first three will later give place to others of faster speed. Considering the tonnage of the British carriers it is evident England is carrying her eggs in more baskets than is the United States. Although the Saratoga is to be armed with eight 8-inch guns in four turrets, and is, like all other ships of war, to be provided with antiaircraft gun protection, it is hardly conceivable that such armament will discourage a determined enemy from attacking such a large target with submarines, destroyers, cruisers and bombing planes. Of course her speed and her large number of combat planes are factors of safety, but foreign powers have cruisers and destroyers with as great a speed. Moreover, it would seem that a single projectile or bomb striking her flying deck would be reasonably sure to wreck it sufficiently to prevent its again being used until extensive repairs had been made.

Without doubt future naval actions will be fought on the surface of the water, under the water and in the air. It would be interesting to know to just what use naval strategists will put such vessels as the Saratoga during some future Jutland. How many times would planes return to their mother ship for another load of bombs; how many bombs would be dropped during such an action; how many hits would be obtained; how many planes would survive the action; how many planes would be brought down by antiaircraft gun fire, and how many ships put out of action by aircraft bombs? In other words to what extent will the use of aircraft carriers influence the outcome of future sea battles?

The Mesopotamia Campaign

When diplomacy fails nations sometimes resort to war in order to gain their ends. Germany as early as 1900 conceived of a German controlled empire that would extend from the Baltic and North Seas as far south as the Persian Gulf. Such an empire, aside from its enormous commercial advantages, would in time of war divide Russia from Western Europe; control the Dardanelles; threaten the Suez Canal; and menace British communications with Asia. Once knitted together it would be all powerful. Turkey was won to the plan and to a large extent the Balkan states. The construction of the Berlin-Baghdad railroad was undertaken. The creation of such an empire threatened the very existence of England, France and Russia. The Kaiser's diplomats used all their wiles to promote this dream, those of the Triple Entente endeavored to frustrate it. Diplomacy failed. The effort of Germany to establish a "Mittel Europe" was one of the principal couses of the World War.

When Turkey entered the war General Leman von Sanders, a German officer, to all intents and purposes controlled the Turkish armies. He mobilized fourteen army corps, one of which he placed at Baghdad, some fifteen hundred miles southeast of Constantinople. Using Baghdad as a base of operations he proposed, with this corps augmented by native troops, to control the wonderfully fertile Tigris and Euphrates river valleys as far south as the Persian Gulf. The British, however, were not to be taken by surprise. General Barrett had been assigned the mission of protecting the British oil base at the head of the Persian Gulf and in November, 1914, arrived there and established an entrenched camp. General Townshend succeeded to the command and by September, 1915, had moved forward and captured Kut-el-Amarah. Baghdad was situated about one hundred and twenty miles to the northwest and he believed it could be captured. The necessary authority having been obtained from the British headquarters in India an advance was ordered. The British found the Turkish forces commanded by German officers in an organized defensive position at Ctesiphon. They attacked but were unsuccessful and in the face of superior numbers were forced to fall back to Kut-el-Amarah. The Turkish forces followed and after holding out for several months General Townshed surrendered his command on April 29, 1916.

Later in the year General Maude was placed in command of the British forces in Mespotamia and after having secured a sufficiency of river transportation moved against the enemy. By maneuvering and fighting he caused the Turkish forces to evacuate Kut-el-Amarah in February, 1917, and thereafter pursued the enemy to

Baghdad. After severe fighting in which the cavalry played a prominent part the place was evacuated and the British forces entered March 11, 1917. Thereafter General Maude made his position secure by taking up advanced defensive positions on the Tigris and Euphrates rivers. This ground the British were still holding at the close of the war.

The Mesopotamia Campaign is a campaign of open warfare, such a campaign as any expeditionary force may be called upon to undertake. Recently excellent books have been published regarding it and contain a mine of valuable information for the Army officer. Prominent among these is "My Campaign" by General Townshend and "The Campaign of Mesopotamia" by General Moberly. Elsewhere in this issue of the JOURNAL is published a study by Major E. W. C. Sandes, an Engineer Officer with General Townshend's command, entitled "The Decision to Defend Kut-el-Amarah." Those reading Major Sandes' article will be able to form some conception of the nature of the fighting in Mesopotamia, and of the difficulties under which the troops there had to operate. Morever, the reader will be impressed by the handicap a commander takes upon himself when he decides to bottle himself up within a fortification with no chance to do otherwise than carry on a purely defensive fight.

Defending War

Do army officers defend war? Do they maintain that war is a medicine that should be taken at intervals by civilization? Regarding this a distinguished scholar of one of our best known institutions of learning is quoted as having made the following statement:

> It seems to me that if the men for instance who are in the group which we know as the military group, if the men who are in the armies and navies, would simply say "we are delegated to maintain the only known establishment for protecting security, and, this being the only known method, civilization not having yet worked out any other way, it is our responsibility to maintain this system at the highest peak of efficiency"—I believe the response would be very much greater to the appeal which they would make than to the appeal of a professionalized group defending war.

Army officers realize that one of their most important tasks is in addressing audiences in schools, colleges, armories, summer camps and civilian organizations, and that their principal mission in these places is in preaching the necessity for National Defense and the

furtherance of our National Defense Policy. It is not believed that these officers defend war. Most of them however, primarily because of the study of the profession they have adopted, are more or less acquainted with the causes that have produced wars in the past and with those causes that may produce wars in the future. If the army group did not have a keen appreciation of the minimum forces absolutely necessary to maintain our present military policy, and did not, when occasion required, speak on this subject, it is almost certain that no class of people would do so, and that the size of the Army would soon be reduced to such an extent that our military policy would be little more than so many empty words. Army officers as a class are no more anxious for war than is the civilian population, and as a class, they, who have a conception of the horrors of war, are much less apt to be swayed by newspaper propaganda than is the average reader. Better than anyone else, they realize that an army is not maintained to wage war, but to keep peace. They realize that a defenseless nation invites aggression and that proper preparedness by a peaceful nation is very apt to discourage an aggressive one from taking positive action. It seems hardly possible that so many people can be blind to the innumerable wars that have taken place in the past, and blind to the conditions existing today that are fruitful causes for future wars.

Army officers do not defend war, but they do assert that civilization has not yet reached the stage where future wars are not probable.

Battleship Annihilators

[The Scientific American]

In the long list of battleship annihilators, the airplane is the latest, and General Mitchell is its prophet. The work of annihilation has been going on for forty years. Periodically, enthusiastic and highly imaginative prototypes of the gallant general have sounded the knell of that hugh, slow-moving, costly contraption, the battleship. Always the mastodon was to be killed by the midget. Always, the midgets were to be "built in swarms"; in swarms they were to "swoop down" upon the bewildered Behemoth; and, as he sank beneath the waves, a new era of naval warfare was to be ushered in.

Yet, strange to say, when the chosen experts of the three leading navies of the world gathered in Washington to arrange a mutual rating of naval strength, they selected, not the torpedo boat, nor the destroyer, nor the submarine, nor the fast scout, nor the swift battle cruiser, nor even the airplane, as the basis of strength. They selected the battleship!

And they made this choice because, although each of these several craft had, in its turn, been heralded as sounding its death knell, the battleship still held its supreme position as the backbone of the navy and the final arbiter of battles; while the "annihilators" had fallen, automatically, into their respective, subordinate positions, as important auxiliaries to the fighting battle line.

The present hullabaloo over the airship-battleship question is strongly suggestive of earlier enthusiasms over cheap "kill-alls" in naval warfare. There was the torpedo boat—small, swift, hard to see, hard to hit, rushing out of the night or the fog, and delivering its deadly torpedo! The answer was found in the torpedo boat destroyer, larger, swifter, heavily armed, and able to keep the sea.

Then the destroyer itself was to succeed where the torpedo boat failed; but an effective answer was found in the rapid-fire, five and six-inch anti-torpedo battery, each gun capable of delivering from six to ten aimed shots per minute at the on-rushing craft.

Next among the annhilators was the submarine; but in the destroyer with its listening devices and its depth bombs was found the annihilator of the annihilator; and in the late war the Grand Fleet did not hesitate to sweep the North Sea, though at times its course was beset with the undersea craft.

And now we have with us the airplane; and, scorning the lessons of the past, its over-zealous advocates are singing the same old swan song and telling the bewildered public and its scarcely less bewildered Congress to consign our battleship fleet to the junk heap; and this for the reason that, at last, it is confronted with a real, honest-to-goodness annihilator.

Well; we think not.

It was our privilege to witness the bombing of the German ships off the Virginia Capes. We saw a small, frail cruiser subjected to an all-day attack by machines flying at a low altitude at which they would never dare to fly in actual warfare. The ship was anchored; she had neither man nor gun aboard. Yet it was late in the afternoon before she slowly went under. The battleship, also anchored and without defense, was bombarded all one afternoon. Next day she was still afloat and but little below her loadline, and it took some hours of further bombing to put her down. We were not impressed.

It is true that planes, bomb-sight and bombs have been greatly improved since then. But so has the antiaircraft defense of ships. The airplane is a most valuable auxiliary in the makeup of a well-found navy. For patrol, for spotting, for scouting, for bombing and for engaging enemy aircraft it will be invaluable.

But it has not "sounded the death knell" of the battleship.

The Regulars Are Coming

[THE CHICAGO EVENING POST]

When the world war broke out the regular army was ready. Handicapped tho it was by lack of numbers, those of the officers who could be spared taught more than the rudiments of leading troops to the thousands who were members of the reserve officers' training camps. And many an old sergeant, given a commission as an officer in the national army, proved invaluable at a time when men with long years of experience were scarce.

Those of the regulars who stayed in the ranks made enviable records overseas, or else played a conspicuous role in teaching the raw recruits in the training camps the little tricks of the army which go to make a good soldier and a "good outfit." And when the war was over they accepted the inevitable demotions cheerfully and faded back into the semi-oblivion to which the United States always consigns the members of its army during the days of peace.

But the regular army is carrying on just as it did in the days before 1917. Not one of its leaders hopes for another world calamity, but each is prepared for unexpected eventualities, as every good soldier should be.

A staff to be effective must possess ability, loyalty, and military character, and, to produce the best results, it must be harmonious. To secure the loyalty of his military subordinates, a commander must set the example of perfect loyalty to his superiors. There is no place in the military profession for envy and jealousy, yet both these exist, and not infrequently. These are human weaknesses, very deplorable, but to be taken into consideration. They have destroyed many fine reputations, and dwarfed the efforts of many characters otherwise admirable.—*Major General Hunter Liggett in "Commanding an American Army."*

PROFESSIONAL NOTES

General Hines on the Hawaiian Maneuvers

Major General John L. Hines, Chief of Staff, and one of the Chief Umpires at the Hawaiian Grand Joint Exercise recently authorized the following statement:

The Grand Joint Exercise just concluded in Hawaii was the biggest and most interesting one ever held by our Army and Navy. It had two principal objects:

1. To test the project and plans for the defense of Oahu; and
2. To train Army and Navy in joint operations.

The problem for the exercise was drawn up by The Joint Board and was extremely simple in form, although its solution was difficult for both sides. The following facts were assumed:

1. That a state of war existed between Blue (the United States), and Black;
2. That the Hawaiian Islands were a Black possession and were defended by the existing armament; the present naval district forces and a garrison of approximately 14,000 men; and
3. That Blue was desirous of capturing Oahu with the object of making use of it as a Naval Base.

The Blue Fleet, accompanied by an expeditionary force of two divisions of troops, was concentrated in San Francisco and put to sea April 15. Under the terms of the problem, the transports accompanying the Fleet were not to be farther than 1700 miles from San Francisco at 5:00 A. M., April 25, 1925, the hour and date when the problem actually opened. The Black or Hawaiian side was restricted to the use of forces and means actually available, whereas the Blue Fleet had two constructive divisions of troops, represented by some 1500 Marines.

Black knew of the impending attack in ample time and estimated that Blue would seize a base on Lanai, one of the islands of the group, preparatory to launching an attack against Oahu itself. Black was in a difficult situation. No reinforcements could be expected and neither air forces, sub-surface nor fast surface vessels were available in sufficient strength to permit Black to deny any of the outlying islands to Blue. The arrangements made for defense were, in general, admirable and were sufficiently carried out, the conduct of practically all forces engaged being exemplary. Everyone was on the *qui vive.* Possible landing places were held by a thin beach cordon, plentifully supplied with field guns, machine guns, etc., and backed by strong points and small mobile reserves. The Black air forces, both Army and Navy, were concentrated on Oahu, seven DH4B's

being, however, despatched to the island of Lanai. The surface and sub-surface vessels and aircraft of the Naval District formed an observation cordon around Oahu at a sufficient distance to give timely warning of the enemy's approach.

Blue's task was also difficult in that it involved an attack against a strongly fortified island some two thousand miles from Blue's nearest home base. In the very nature of the case, such an attack was a major operation and therefore required extensive and careful preparations. Since a direct attack against Oahu was too hazardous, Blue planned to seize one of the outlying islands, Molokai, and to establish an air base there and to follow this with a naval demonstration against a bay on the south coast of Oahu for the purpose of diverting Black's attention. Blue then proposed to direct his main landing attack against the North Coast of Oahu, while simultaneously therewith making a secondary landing on the west coast of Oahu.

Blue made his dispositions accordingly. Blue was successful not only in seizing Molokai, but Lanai as well and in occupying the landing fields on both islands early on the 25th. This success may be ascribed in large measure to the fact that instead of moving the airplane carrier Langley close inshore and exposing her to attack by Black submarines, Blue kept her well offshore and had her fly her planes off to the landing fields on Molokai and Lania as soon as these had been seized by the Advance Force. The seven Black airplanes despatched to Lanai gave a good account of themselves, sinking a Blue tender and inflicting serious damage on the Blue landing forces. They were far too weak to prevent the seizing of the two islands.

Black anticipated that the main hostile attack would be launched against the West coast. With the forces at his disposal, it was physically impossible for the Black commander to have adequate local reserves on both West and North coasts, and to hold out general reserves.

Confronting two attacks, one on the West coast and one on the North, he felt compelled to estimate one as the main attack and the other as secondary, The immediate consequences of a successful attack on the West coast were more serious than on the North coast. Therefore, Black placed the bulk of his forces so as to meet this attack. With adequate general reserves to meet any action of Blue this risk would not have had to be taken. As it turned out, the bulk of the Black forces were too far from the North coast of Oahu to repulse the major debarkation promptly.

Blue had been successful in seizing a base in dangerous proximity to Oahu. With local command of the sea and with a superior air force in his hands, Blue was reasonably sure of ultimate victory. But Black aircraft and submarines did all in their power to make winning as hard and costly as possible to Blue.

Blue's first move against Oahu cosisted of a naval demonstration on the evening of April 26th. This was designed as a feint but did not have any practical result for it did not deceive Black for a moment and merely served to bring Blue ships under the fire of heavy Black batteries. Blue then launched his main attack against the North (or open) coast of Oahu at daylight on the 27th, landing troops under cover of and supported by heavy fire from his ships. The weather was ideal and there was practically no surf. The landing was vigorously opposed but the defense forces finally had to retire. Simultaneously with this main attack Blue made a secondary landing on the West coast under cover of and supported by, heavy fire from his ships. Here considerable surf was encountered and the landing failed in face of the vigorous defense. It is to be noted that both land-

ings were planned to begin at 1:30 A. M., April 27, but orders were issued that they were actually to begin four hours later so as to obviate the inevitable hazards of life and materiel involved in making landings at night.

Since the bulk of the landing forces was constructive, the arrangements for the landings were extremely complicated, but apparently worked without a hitch. Each boat carrying a large signal flag in the bow as it approached the shore represented a tow of boats. The character of the troops actually or constructively carried by boats was indicated by these flags.

A beachmaster (naval officer) and beach detachment were designated for each beach. Beach parties were debarked in first waves, but not in leading boats thereof.

The aircraft with the Expeditionary Force were to furnish illumination (flares) for beach bombardment and smoke screens to cover first landings; to reconnoiter hostile gun positions and troop movements; to spot for covering and supporting gun fire.

Careful provision was made for marking the extent of each beach and the approaches thereto. A schedule for unloading each transport, showing tows, etc., was prepared on each transport and a schedule of the trips of each tow was prepared by the senior officer of each tow and furnished each boat officer. Each beachmaster likewise prepared a schedule for the troops and materiel to be landed at his beach.

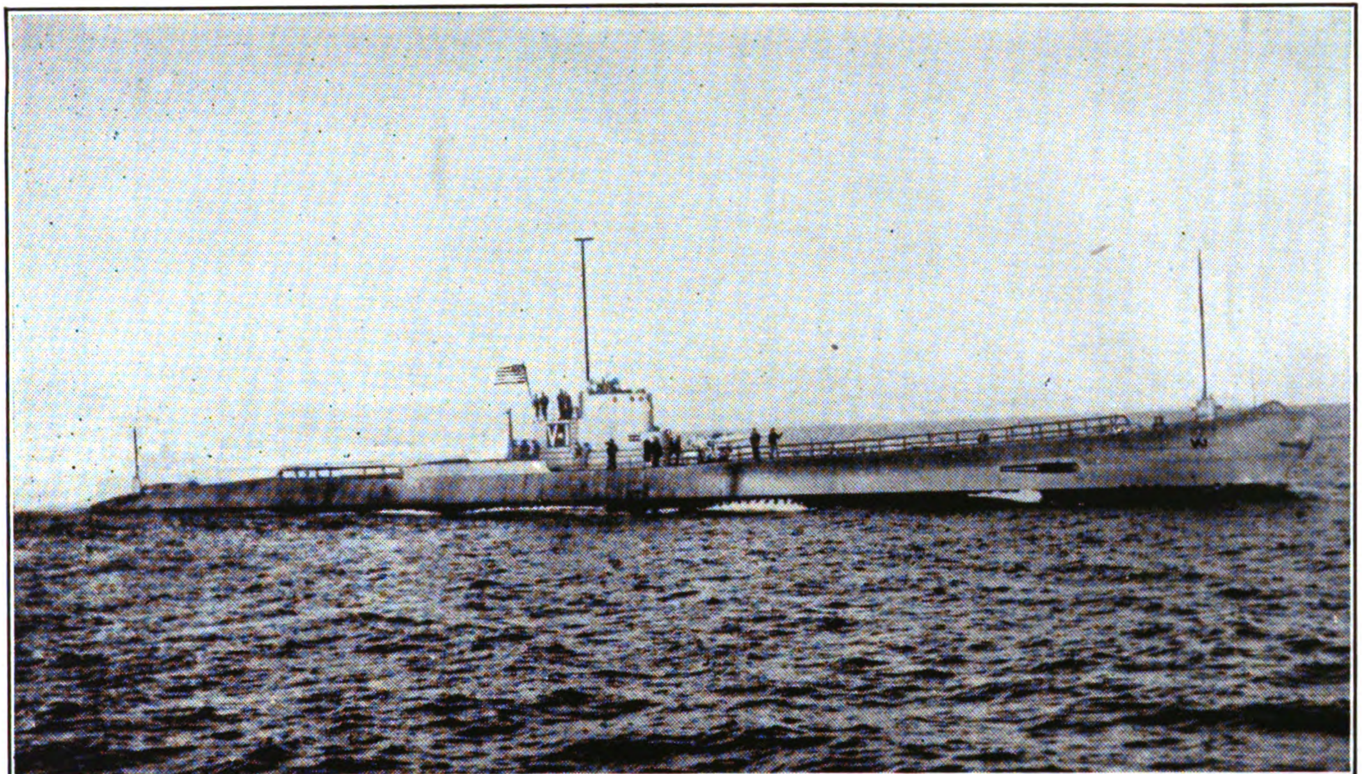
It is of course extremely difficult to say whether either landing would have succeeded in an actual case. The local umpires on the spot were of the opinion that the landing on the North coast succeeded. Blue suffering severe losses, and that the landing on the West coast failed. Considering the two cases on their merits, I am of the opinion that the landing on the West coast would probably have failed in war, but that the landing on the North coast might well have succeeded. There is no doubt that highly trained, well led infantry can establish a beach-head once the troops are ashore. Even when the landings, as in the exercise, are well planned and covered by naval gun fire, the guns defending the beach will sink many boats, perhaps even transports. Even under the best weather conditions, the critical period of a landing operation is that in which the landing troops are moving in boats from transports to beach. During this period they are exposed helpless to the gun, machine gun, and rifle fire of the defender, and in case he has any aircraft left, to attacks by the latter.

But these landing operations demonstrate another lesson. The defense against them must be flexible and mobile. Dependence must not be placed primarily or even predominantly upon mechanical means—field guns and machine guns—but upon mobile troops and aircraft, counter-attacking whenever and wherever necessary. A commander must not only have troops enough to hold the essential positions and to man his armament, but he must have enough troops left to form an adequate reserve. In this instance, the commander could not do this, for his force was not adequate for the task assigned to it. He did all he could with the forces given him; he could not do the impossible.

Analyzing the results of the exercises from the standpoint of their objects, it is believed:—

1. That the project and plans for the defenses of Oahu have been tested and that the deficiencies therein have been disclosed.
2. That very valuable training has been given the Army and the Navy in joint operation.

These results fully justify the time and effort spent in the exercises.



U. S. Fleet Submarine V-1

The V-1 recently went into commission, being the first of three large cruiser-submarines authorized for the Navy. Displacement, 2025 tons. Length over all, about 335 feet. Armament: six 21-inch torpedo tubes; one 5-inch, .51-caliber rifle; one 3-inch antiaircraft gun, and two Lewis machine guns. It carries 16 torpedoes. Speed: surface, about 21 knots; submerged, about 10 knots. The V1 can maneuver with the fleet and is equipped with a complete Sperry Gyro-Compass system. It carries a navy standard 24-foot whale boat and a standard 24-foot motor launch. The crew consists of 7 officers and 80 men. The V-1 is designed to permit its making any voyage of which the whole fleet is capable.

The Coast Artillery Corps and its Relation to Other Branches

By Brigadier General H. D. Todd, Jr., *U. S. Army*

Editor's Note: *The following remarks have been extracted from a lecture recently delivered by General Todd at the Staff Training Camp, Ninth Corps Area*

Among the missions of the Ninth Corps Area, if not the principal mission, is the defense of the Pacific coast from Canada to Mexico.

Any delay or failure in the mobilization and concentration of the military units for operation in a distant theatre in war time might be excused but the Ninth Corps Area will not be excused if invasion of the United States occurs over its coast line.

Coast defense has two meanings—in addition to its meaning the defense of the coast, it also refers to a group of forts provided for the defense of a harbor or point of the coast. In this discussion, coast defense will be considered in its general sense, that is, the expression will mean the defense of the coast in general. Such defense must be planned: (a) To repel naval raids; and (b) To prevent invasion from the sea.

Raids may occur at any time after the declaration of war. Japanese destroyers dashed for the harbor entrance at Port Arthur within a few hours of the time that the Japanese Ambassador at St. Petersburg received his passports.

Invasion will not be attempted until after the enemy has secured temporary or complete command of the sea. Raids have various objectives. They are undertaken to cause fright or disgust with the war, injury to public utilities such as power plants, reservoirs, railroad terminals, bridges, tanks, warehouses and banks, or they may have the direct object of injuring units of our fleet while at anchor within a harbor. They come suddenly. For instance, during the late war, upon the lifting of a fog the heavy and fast battle cruisers of the German navy began the shelling of Scarborough and Hartlepool.

Invasions in force are deliberate affairs, carefully prepared beforehand and, to be successful, the defenders must not only be outmatched but the invading force must find landing facilities for the immense amount of the heavy supplies of an army, including its guns and means of transportation. That is, the enemy must occupy a deep, sheltered harbor with docks, cranes, warehouses and well constructed railroads leading into the interior of the country.

The fortification of an entire coast line is impossible. In fact it is not necessary for the facilities just referred to do not exist except at the principal harbors.

However, as the landing of a quickly moving column within, for instance, a day's march of a harbor might be attempted so that the fortifications of the harbor can be taken from the rear, it is necessary to plan all defenses so as to resist an enemy at all landing beaches, in addition to the principal harbors.

Such a system has been provided; it is known as "A Positive System of Coast Defense." In this system the basic idea is this: "The enemy must be denied access to any landing place upon which he could quickly establish himself in force, but it is not necessary to defend places where a landing would be so difficult that an enemy would be unable to land in sufficient strength before reserves could be brought up in sufficient numbers to dislodge him."

Under this system the line of resistance is the water line and the "strong points" are the important seaports.

For an invasion to have a chance of success the hostile troops must occupy what can be called vital areas. In the Ninth Corps Area these are: (a) The area including Puget Sound and the mouth of the Columbia River; (b) San Francisco

Basin, and (c) The Southern California Area from Los Angeles to San Diego, both inclusive.

We find, therefore, that strong points have been provided at: (a) Puget Sound; (b) Mouth of the Columbia River; (c) San Francisco Bay; (d) San Pedro Harbor; and (e) San Diego Harbor.

Each of these strong points has three distinct missions: (a) To deny the enemy possession of the port and its facilities; (b) To prevent destruction or serious injury by bombardment of the harbor utilities; and (c) To provide an area off the harbor entrance in which naval vessels and merchant shipping will be protected as far as possible against all forms of enemy attack.

If these missions can be fulfilled an invading enemy must make his initial landing elsewhere; that is, on some beach where no facilities exist for getting ashore the enormous impedimenta of an army and hence where he may be defeated by a quick concentration of defending troops.

The Coast Artillery Corps is charged with the service of the fixed and mobile elements of the land and coast fortifications, all railway artillery, antiaircraft artillery and trench mortar artillery. Hence, this Corps is charged with manning the armament and its accessories of the forts guarding the important harbors. It is seen, therefore, that considering the navy as the first line of defense, the Coast Artillery Corps is the principal component of the second line of defense.

The strong points manned by the Coast Artillery must be held; there can be no withdrawal, our important harbors must be made bullet proof and then, if our flanks and rear can be made secure against attacks from comparatively small forces, invasion of the country at large can be prevented with certainty.

It is the mission of the other combatant arms of the Army, (Infantry, Field Artillery, Cavalry, etc.), to prevent such forces from landing on the beach and by short and quick movements, attacking seacoast forts from the rear. Consequently there must, at all times, be the closest cooperation, as is the case in any line of resistance, among all forces engaged.

It was stated above that the Navy is the first line of defense. The mission of the Navy is to destroy the oversea communications of the enemy and protect our own sea communications. The Navy cannot perform its mission unless it has secure bases where it can be guaranteed absolute protection. In other words, the harbor defenses must be capable of fulfilling the three missions described above.

To decide whether or not the harbor defenses manned by the Coast Artillery Corps can fulfill these missions requires an "estimate of the situation." To make such an estimate we study the power of foreign fleets and compare their power with the fixed armament of our seacoast forts and its accessories.

To aid in such a study we have an excellent book called "Jane's Fighting Ships," which is published yearly and which gives an accurate description of every fighting ship in the world. This description includes, in detail, the thickness or armour on the various parts of the ship, the number and caliber of its guns, the weight of projectile, muzzle velocity and in many cases the elevation that its guns can be given. There are also given in this book the number of men composing the crew, the speed of the ship, its fuel capacity and its radius of action at different speeds. In addition to the above data, the book gives the number and kinds of planes carried, not only by the regular airplane carriers but by ships of other classes.

A comparison of this data, with the number and class of the guns in our seacoast forts gives with almost mathematical certainty the estimate of the situation we desire in order to decide whether or not our harbor defenses can fulfill the missions assigned to them by the War Department.

Reference has been made to the accessories of the fixed armament in the seacoast forts. Under this heading are grouped the mines, the searchlights, the mobile guns, both of the heavy field and railroad type and such units of the Air Service as may form the garrison of the harbor defense. The highly technical nature of the duties of the personnel forming the garrison of seacoast forts requires not only long training but ability to master at least the elements of civil, mechanical, electrical and steam engineering. To obtain a working knowledge of ordance and gunnery one must know the elements of chemistry of explosives, interior and exterior ballistics, includings a knowledge of the simple problems in trigonometry.

It is seen, therefore, that an efficient Coast Artillery Corps cannot be produced in a few months. The complex duties of officers and men in the garrisons of seacoast forts require hours of study on the part of the officers and many hours of drill on the part of enlisted men. At present the second line of defense of the country is weaker than it has been since before the Spanish War and even if men and material were supplied it would take at least a year to make it sufficiently efficient to repel naval raids and prevent invasion from the sea.

The remedy for such a condition lies to some extent, if not to a large extent, in the hands of the Organized Reserves. Owing to their number and their contact with the civilians throughout the country they can inform them of the condition exactly as it exists and also indicate the method of improvement.

Rating Coast Artillery Batteries

By Lieut. C. E. Brand, C. A. C.

Coast Artillery Memorandum No. 1 (now rescinded and replaced by certain other regulations) enumerated certain factors by which *Coast Defense Commanders* should judge the comparative excellence of their batteries in artillery firing. The first factor, "hits per gun per minute" upon a prescribed hypothetical target, is susceptible of exact and unquestioned determination. The remaining seven factors may be more or less exactly determined. This is certainly superior to the former system of rating, upon broader generalities, though both systems are equally certainly based upon fair and correct artillery principles. Even the latter, however, is fatally defective in affecting really competent and unbiased ratings based upon demonstrated proficiency in artillery firing in that an exact percentage of importance should be assigned to each factor; an exact method should be prescribed whereby it could be ascertained what percentage of the allotted comparative value of any factor is merited by any firing battery; and the artillery district commander, who actually does the rating, should be bound by the prescribed rules instead of merely the coast defense commander. Such a system of rating would give the battery commander a definite goal of accepted recognition of merit to reward his efforts (or lack of it to condemn his failure) and would establish at once a relative scale of ratings on the same basis for the entire corps.

Using the factors enumerated in Coast Artillery Memorandum No. 1 referred to above as a basis, the following scheme of factors and weights and methods of determining the points of each factor rated by any particular battery is proposed as possible. Better and simpler schemes can doubtless be devised, but this is the idea:

(1) Shots per gun per minute, considering the type of gun and range and course of target: Weight 10 points.

(2) Mean longitudinal and lateral deviations of shots: Weight 10 points.

(3) Mean longitudinal and lateral errors of shots: Weight 10 points.

(4) Extent of personnel errors: Weight 50 points.

(5) Correctness, smartness, and smoothness of drill; general appearance of personnel: Weight 5 points.

(6) Condition of battery material: Weight 5 points.

(7) Solving the firing problem: Weight 10 points.

Total weight: 100 points.

It will be noted that in the above the factor "hits per gun per minute" is changed to "*shots* per gun per minute." While it is desired to give credit for a rapid rate of fire, under the conditions explained in the rules, this change will prevent rewarding or penalizing a battery because of any particular manifestation of the laws of probability in the case of the few shots which it has to fire. This in no way modifies the accepted proposition that the *mission* of the Coast Artillery is to secure *hits;* not merely to fire shots. And the test of any such set of factors as the above must in fact be the extent to which a high score made under them indicates directly the ability of the firing battery to secure the maximum in "hits per gun per minute,"—*in the long run.*

The following scoring rules for major caliber guns are suggested. Similar rules varying in minor particulars would be necessary for mortars, for rapid fire guns, for mine companies, antiaircraft companies, etc., the principles remaining the same for all.

The prefixed numbers indicate factors, as tabulated above, which are not repeated and must therefore be referred to in each case.

(1) *100 per cent conditions:* Range above 16,000 yards, or 80 per cent to 100 per cent maximum; course curved at least 15° each 1000 yards; speed not less than 21 knots; 1 shot per gun per minute.

Deductions: For each 10 per cent or each 2000 yards average shorter range down to minimum of 10,000 deduct 10 per cent of points scored. For 10°-15° course (i. e. for course curved at from 10 to 15 degrees per 1000 yards) deduct 5 pe rcent of score made; for 5°-10° course deduct 10 per cent; for 1°-5° course deduct 15 per cent; for less than 1° course deduct 20 per cent. For speed less than 21 knots deduct 2 per cent for each knot reduced down to 9 knots, which is the minimum allowed. Hypothetical target may be used if actual target of high enough speed cannot be secured.

Total elapsed time will be taken as prescribed in Coast Artillery Memorandum No. 1. It will be noted that no time is allowed for slow spotting, which implies that the battery is responsible for its own spotting. Notation of defects in material for which time is taken out, will be supplemented by a statement from the local ordance officer that the defect in fact could not have been foreseen by the battery commander and by a copy of a letter from the fort commander reporting the defect to the Department Commander for such remedial action by the department ordnance officer as may be necessary.

(2) Deduct 1 per cent for each 3 yards and for each .01° over two-thirds the probable error of the piece (the latter to be uniformly prescribed for all similar cannon).

(3) Deduct 1 per cent for each 3 yards and for each .01° over two-thirds the probable error of the piece.

(4) This refers to errors in observing, computing, and applying firing data. Any other irregularities come under "correctness of drill." The following records must be kept as a basis for the analysis:

Azimuths read by B′ and B″ readers.

Azimuths set by arm setters.

The plotted course of the target properly marked so that it may be replaced on the board.

The range to the setforward point called off by the plotter.

The azimuth of the setforward point called off by the arm setter.

The range used by the Pratt Range Board.

The range and azimuth used by the wind component indicator.

The range and azimuth used by the deflection (or azimuth correction) board.

The meteorological message.

The several corrector settings on the Pratt Range Board.

The reported deviations, longitudinal and lateral.

The corrections ordered from observation of fire.

The correction settings used on the time-range and time-azimuth boards (arbitrary and ballistic separate if so kept).

Traces of the curves made on these boards.

Corrected ranges and azimuths called off to the guns.

Ranges and azimuths received at each gun.

Azimuth displacement corrections received at guns (range corrections should be painted on the emplacement).

Setting of guns in both range and azimuth marked with pencil or chalk on the range drum and racer the instant before firing.

These records should be supplemented by whatever others may be necessary to cover any special methods used and to insure that each individual operation in the computation and use of all firing data is completely checked.

No errors will be considered unavoidable except failure of the plotter to locate the actual future position of the target as the setforward point under conditions when a change in course or speed occurs which is not clearly foreshadowed by its preceding plotted positions When a change is so foreshadowed reasonable latitude (up to 100 yards with fast moving targets) should be permitted in the prediction. The fire commander shall be the judge of the plotter's errors as to the proper travel and direction of target course adopted as the basis for the prediction.

100 per cent conditions—No resultant avoidable error greater than 10 yards in range (30 yards for spotting) nor .03° in azimuth.

For each resultant avoidable error in 10 shots within 30 yards in range (60 yards for spotting) or .10° in azimuth (this to be computed as result in change in firing data finally set on gun) or multiple thereof, deduct 5 per cent, provided that deduction for any one shot in 10 shall not exceed 10 per cent, and deductions on account of one man shall not exceed 20 per cent. However, the maximum deductions possible under these provisions shall be made.

The coast defense or district commander shall hold prior to the firing a technical inspection of each battery during which it will be required to hold a drill on a hypothetical curved course at not less than 21 knots speed unknown to the battery personnel. All the processes involved in firing will be gone through as nearly as possible and not less than 10 simulated shots fired. This drill will be analyzed just as prescribed for firing problems, and the rating upon errors made determined in the same manner. Fifteen of the 50 points allotted to personnel errors will be determined from this technical inspection. If additional firing problems are held this technical inspection preceding such additional firing problems may be dispensed with at the option of the coast defense or district commander and the entire 50 points based upon the actual firing.

(5) This will be determined by the coast defense commander who will make a careful inspection of the firing battery immediately before and during the firing. Defects will be called to the attention of the battery commander and points allowed each of the several batteries announced in orders.

(6) Same as (5), above.

(7) Use of correct methods by the battery commander will count 50 per cent and the actual attainment of the end will count 50 per cent. Errors in fire adjustment will be charged against this item.

The coast defense commander after his annual critique will announce the ratings of all batteries in his command itemized under the above heads and by totals.

All organizations making a total of 80 points or more will be classified as *Excellent;* those making 70 or more, but less than 80, *Very Good;* those making 60 or more, but less than 70, *Satisfactory;* those making less than 60, *Unsatisfactory.* A battery whose rating is unsatisfactory will be required to write a letter through channels to the artillery district commander explaining the cause of failure to attain a higher rating.

The Human Element versus Mechanical Devices

Combat is carried on by two main elements, i.e., (1) Man or the human element and (2) Mechanical devices. Mechanical devices are worthless without men to employ them. Mechanical devices cannot win a battle. The decisive factor in battle is man. The race that has developed most in the leadership, mental, moral and physical qualities of its man-power will win against another race whose strength rests on a great development of mechanical device. In all walks of life as well as in combat, man has always and always will be able to compete with and dominate the instrument of his own creation. No one who has faced battle in its real aspects will dispute this assertion.

The Meuse-Argonne is the greatest battle America has ever fought. One million American soldiers fought in that battle under their own leaders. The battle was a continuous fight for 47 days and nights and may be divided into these periods:

First, September 26 to October 2—6 days, average of 7 miles advance made.

Second, October 3 to October 31—29 days, average of 6 miles advance made.

Third, November 1 to November 11—12 days, average of 50 miles advance made.

The battle was won in the second period.

For 29 days and nights, the American man and the German fought continuously, in rain, in cold, with guns, with gas, with rifles, with bayonets and even with fists. In fact there were constant hand to hand battles in this period. Here was the test of the opposing leadership, mental, moral and physical qualities. Here the American defeated the German man. There was no test of German mechanical device against American mechanical devices. These were on a par. At the end of the 29 days the German man ran away not because he lacked artillery, gas, machine guns and other mechanical devices, but because his mental, moral and physical qualities—his manhood—was defeated and subdued.

It is a common fault, associated with the piping times of peace, to forget or overlook such vital lessons. Our natural tendency is to stress the value of mechanical devices and forget the supremacy of man on the battle field. Our newspapers and magazines since the war have been filled with the mechanical

side of war. Daily you read of the wonderful development in aviation, in tanks, in long range guns, in chemicals. You read predictions of the great destructive effect of new gas, new bombs, etc. When and where do you run across articles touching upon the real vital factors of war, leadership and the mental, moral and physical qualities of our manhood? Have we these qualities in such superabundance that we may neglect cultivating and training them in our manhood?

I fear manhood and citizenship education is too often submerged by the great commercial, industrial and financial development going on in our country. I hope our colleges and schools will not be blind to our present tendencies. I hope they will always insist upon the predominance of the human element in all educational work. With a sound manhood and loyal citizenry, we need never fear for our commercial, industrial and financial problems.—*Extract from address by* BRIGADIER GENERAL HUGH A. DRUM.

The Mysterious Weapon

By LIEUT. COL. WESTON JENKINS, 390TH INFANTRY

[REPRINTED WITH PERMISSION FROM THE *Infantry Journal.*]

It is a curious thing how certain traits in human nature produce the same recurring fallacies from generation to generation. Certain superstitions such as walking under a ladder, starting a journey on Friday, thirteen at a table and so on, persist even when we know better. Like Mark Twain we don't believe in ghosts but we are afraid of them just the same.

One of these ghosts that will not be laid is the spectre of the mysterious weapon. One never just knows what it is, but its devotees are positive that it is deadly beyond anything yet conceived. No one can be found who has seen it, yet that to these believers in ghosts is certain proof that it exists.

This ghost of the mysterious weapon dates back to the beginnings of history. Then, as now, it was probably used as propaganda to frighten the enemy. King Arthur had Merlin with his incantations and enchantments. His good sword "Excalibur" ranked high in the category of mysterious weapons. All through the Middle Ages necromancy figured in war. The first use of cannon was to frighten the enemy. The Japanese used to wear frightful masks to strike terror to the hearts of the foe.

At the battle of Bladensburg in the war of 1812 the British worked on the fears of the American militia with reports of a mysterious and deadly rocket. This succeeded so well that the militia broke and ran from the field after sustaining a loss of only a few men.

At the commencement of the World War, there were persistent rumors of a great and deadly secret that was to be resurrected from the archives of the British War Office. This secret had been deposited there years ago and was only to be looked at when England was in the last ditch, when everything else had been tried and had failed. It was so terrible and deadly that all knowledge of it had been suppressed. Of course, it never appeared. When England and France were in the last ditch, it was the Americans they called upon, not the mysterious weapon.

Another of the same sort was the mysterious French gas we heard so much about early in the war. A drove of sheep, we heard, had been turned loose in a pasture, a shell dropped near them, and when the correspondents came up, there were the sheep like Senacherib's hosts, scattered and strown. Not a mark on them, but all dead as Judas Iscariot.

The believers in necromancy are not all dead. There are still those who preach the gospel of the mysterious weapon which will annihilate thousands with a breath; a mist which falling from the sky will poison a countryside so that not one living thing will be left, not a blade of grass, not a worm, not even a germ. They have not seen it, but they have heard of it. It will make war impossible.

Now I do not doubt that there are some very deadly gases which may be used in future wars. I do doubt, however, that there is a gas which can be produced in quantity which will kill by a touch. I doubt that there is in nature any such store of poisonous material which can be extracted without a prohibitive amount of labor and expense, which might be put into other military agencies with better effect.

In this same line an ingenious electrical expert once figured that the United States could be rendered invulnerable by surrounding it with a deep belt of electrical flame, something on the same order as Dr. Steinmetz's artificial lightning. No enemy could penetrate this wall of living fire. Putting aside the obvious defects in the system such as the destruction of the feed wires by artillery and the vulnerability of the complicated apparatus to airplane attack, it was figured out how much such a system would cost for our extensive frontier and the amount of electrical power necessary. I do not remember the figures, but the amount of money it would cost would bankrupt the world and the power required was more by many times than all the sources of power available in the world.

The diabolical ray, vibrations of the ether, necromancy, and all similar ideas belong to fiction, not to the stern business of war. There has never been a war won by them yet and there never will be a war won by them. Wars are won by the will of the peoples fighting them and by no other method. There is no royal road to victory. Hard work, fighting ability, training, equipment equal to the enemy, and above all the will to win, the will to endure, to suffer, until the goal is reached, by both the soldiery in the field and the citizenry at home. These are the ingredients of victory. There is no mysterious weapon that can overcome the unquenchable spirit of a determined people. The more energy put in side issues like these, the more taken away from the main issue, the destruction of the enemy armed force. These things are in the nature of dispersion of force, the cardinal military sin. Battles are won by hard fighting and intelligent leading. The brunt of the fighting that is now, that has been in the past, and that will be in the future, is done by the man on foot and the most terrible weapon yet known to man is about five feet eight inches long and weighs about one hundred and fifty pounds. It is known as the American Doughboy.

Now, my object in writing this is not to pooh-pooh the possibility of the invention of terrible implements of warfare, nor is it to minimize the dangers of war. "War is hell" and we know it from personal experience. Not the experience of a personally conducted tour, but the experience of months of hardship and constant danger. My object is to present the subject in its true relation to our national defense, to guard against giving such theories too much weight in shaping the course of our ship of state.

There are those who would frighten the country into one or another policy in the search for the prevention of war, not by our judgment whether such a policy is wise or not, but by high pressure sales methods, scaring us with the vision of a world desolated by man's inventions. The same method that is being used by the vendors of patent medicines who first describe some ordinary symptoms man is heir to, then tell what terrible diseases these symptoms foretell. When the individual feels all hope is gone, the remedy is sprung: "There is Hope"—"Dr.

Knownothing's Remedy." Not only that but this same vision is used as an argument why we should scrap our entire system of national defense. If I believed in these mysterious weapons, it would seem to me the logical thing to do would be to study them, to understand them, and to contrive a defense against them, for maybe some naughty nation some day might use them against us.

A weapon which seems terrible today is commonplace tomorrow. Julius Caesar would have thought a blunderbuss a terrible invention and would be of the opinion, probably, that there was no defense from it. George Washington would have thought the machine gun with its stream of bullets would forever make the attack impossible. Yet, we have found the way to overcome them. Gas would have confounded Napoleon in his day. Yet, we have found the defense against it.

Give one man a sword and put him up against an unarmed man and two seconds will decide the fight. Give the other man a sword and you have an entirely different condition. Give them shields and armor, and the fight will be a long drawn out affair.

Early in 1914 a very clever man wrote a book proving that war was impossible. He had it all figured out. So many machine guns shooting so many bullets per minute; so many field guns shooting so many shrapnel, each with so many pellets, no one could live in the tornado. His prediction was that at the first encounter there would be a puff and then both sides would be annihilated. The nations would stand aghast and the war would cease then and there. We know now how silly this prediction was. Yet we also know that others are now talking the same old story and years from now still others will be repeating it, though it be disproved one thousand times.

It would do no harm to believe these fictions if that was all there was to it. But that is not all there is to it. If people believe them they will get panic-stricken and depend upon equally false ideas to protect them from these terrors. The safety of our country cannot be entrusted to any such wild thinking. It rests now as in the past and will rest in the future on the courage, will, and ability of our citizens to face with a stout heart, whatever vicissitudes fate has in store for us.

Small Arms Target Practice—1924

A bulletin was recently issued from the Office of the Chief of Coast Artillery tabulating the results of small arms target practices, both rifle and pistol, of regular organizations of the Coast Artillery Corps for 1924, and commenting upon the same. On the whole the results were not considered satisfactory, the majority of units having failed to attain the 80 per cent qualification standard as required by the War Department. Some of the units that did attain this standard fired only a small percentage of their personnel, and other units postponed the target practice season until so late that weather conditions precluded making any sort of showing.

The Chief of Coast Artillery in the Bulletin stresses the point that small arms firing *is important* and that it is expected that, considering the ease of the courses fired, organization commanders will qualify at least 80 per cent of their commands during the 1925 target practice season.

The bulletin states "It is believed that little difficulty will be experienced in qualifying 80 per cent, or better, of an organization if preliminary work is conducted during the season allotted to gunners instruction. A small amount of daily instruction in holding, squeezing, adjustment of slings, bolt manipulation,

use of sights, and gallery practice given properly during this period will be highly beneficial and should not interfere with the instruction of gunners. And if the period can be followed by range work there should be no difficulty in attaining a proper standard."

Army Regulations states "Under ordinary conditions the regular practice season for the Regular Army will cover a period of six weeks for each organization." In connection with this the bulletin has the following to say "It is considered that, for 80 men firing on a five-target range, a total of 10½ days is sufficient for range work in firing Course "C" as laid down in T. R. 150-10, *provided they have been properly instructed* in accordance with the principles laid down in training regulations. This includes both instruction practice (9 days) and record practice (1½ days) and is based on allowing 18 minutes for firing ten shots slow fire and changing relays in instruction practice and 13 minutes in record practice; and five minutes for firing ten shots, marking the targets and changing relays in rapid fire both in instruction and record practice. More time is of course desirable but this length of time will permit a four battery regiment to complete its range work (except supplementary) in six weeks and with creditable results. The allowances of .30 caliber rifle ammunition have just been reduced to 160 round for unqualified men and 110 rounds for requalification, and pertinent training regulations are to be changed accordingly. This will materially reduce the time necessary for range work."

The bulletin commends the following organizations for excellent results attained, not only on account of the percentage qualified but also because of the high rating of the men who were required to fire.

91st C. A. (P. S.) (H. D.) Fort Mills, P. I.—Rifle.

3rd C. A. (H. D.) Fort McArthur, and Fort Rosecrans, California—Rifle.

62nd C. A. (A. A.) Fort Totten, New York—Pistol.

61st C. A. (A. A.) Fort Monroe, Virginia—Pistol.

The bulletin tells of a small arms firing report just received from one regiment in Hawaii. The record made by this regiment is far superior to its 1924 record, both as to percentage qualifying and as to the number completing the course. The Commanding General of the Hawaiian Separate Coast Artillery Brigade, in forwarding this report, stated "Exceptional results have been obtained by this regiment in small arms firing. This is very gratifying and is attributed to the slogan '100% must be the objective in every activity,' and to the intelligent and explicit following of training regulations."

The Chief of Coast Artillery believes that if T. R. 150-5 and 150-10 are carefully and intelligently studied and the principles outlined therein are followed explicitly, Coast Artillery units will attain excellent results in small arms target practices.

Fort H. G. Wright, N. Y.

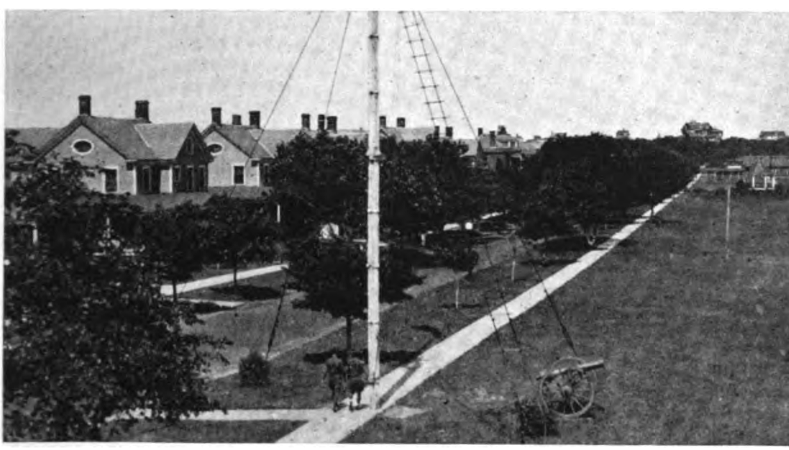
By Captain F. S. Swett, C. A. C.

Fort H. G. Wright, N. Y., is located on Fishers Island, in the eastern end of Long Island Sound, a few miles from New London, Connecticut.

The island was first visited in 1614 by a Dutch navigator, one Captain Adrian Block, who having named the larger island a little further east after himself, may have honored a companion of the voyage, Visscher, by naming this previously unnoted island after him. Fishers Island probably, however, was so named because of its position in the early fishing grounds, as the present Montauk Point at the end of Long Island was formerly known as Fishers Hook.

The Pequot Indians who originally occupied the island were driven out in 1637 by combined forces of the English, Mohegans, and Narragansetts, and the great battle of that time in connection with later grants by the General Courts of Massachusetts and Connecticut resulted in its acquisition by John Winthrop, Jr., who in 1644 further justified his holding by purchasing proprietor rights from the Indian inhabitants. With his family he actually lived on Fishers Island at intermittent periods in a house which occupied the present site of the Mansion House until May, 1647, when he moved to New London.

The island legends indicate the usual trouble and strife with the Indians, although no serious encounters occurred subsequent to the eviction of the Pequots in 1637. Captain Kidd, the notorious pirate, operated in the surrounding waters during the late sixteen hundreds, and many a spadeful of earth has been



OFFICERS' ROW—FORT H. G. WRIGHT

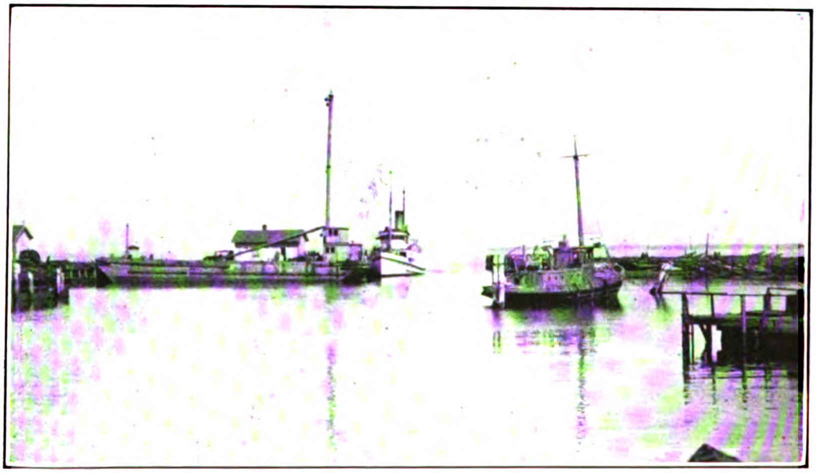
turned on Fishers Island in vain search for his hidden loot. Being located in a main path of navigation and so close to the early settled colonies, the island was frequently involved in the many struggles and disputes between the Indians, English, French, and Dutch.

The strategic importance of Fishers Island was recognized in colonial days. There was advocated in 1690 and executed in 1704, the establishment of a signal beacon on Prospect Hill to give warning of the approach of an enemy on New London. To quote, "and whereas there is a former order of council for the keeping of a ward upon Fishers Island for the discovery of an approaching enemy in order to give a more timely notice to New London by fixing one or two beacons made on said island for that account it is now ordered that the beacon made on the west point of Fishers Island shall be fired upon discovery made from Mount Prospect of one ship, or two other topsail vessels standing in towards said island from the southard or northard of Block Island or upon discovery of five ships standing in from the southard or five from the northard of Block Island, and that both beacons on Fishers Island shall be fired upon the discovery of a greater number of vessels standing in as aforesaid."

In 1898 the Government purchased a tract of 261 acres at the western end of the island for the establishment of coast defense fortifications, and construction of

battery emplacements began almost immediately. Later on it developed that Prospect Hill and North Hill afforded necessary tactical advantages and they were added to the reservation. The post was named after Brigadier General Horatio Gouvernour Wright, a retired Chief of Engineers, who rendered distinguished service to the Union in the Civil War. Built at a cost of approximately eight million dollars, it became the headquarters post of the Coast Defenses of Long Island Sound, with Forts Terry, Michie, Trumbull, Mansfield, and Tyler as units in the command. The last three have since been abandoned.

The post is necessarily self-reliant with respect to its electric power and telephone systems, and practical working knowledge is obtained by the many operators under actual conditions of service. Theoretical training is greatly augmented by practical experience.



BOAT HARBOR—FORT H. G. WRIGHT

Fort Wright is happily situated with respect to facilities for amusement. The civilian portion of the island has in late years developed into a popular summer resort, and throngs of vacationists furnish means of a multitude of diversions throughout a large part of the year. New York and the large cities of New England are so closely adjacent as to make reasonably accessible their many and varied programs of sports—major league baseball games, the more important football classics, boat races, etc.

Command Qualities

In chapter II of the Mailing List of the General Service Schools for December, 1924, appears a discussion of the Command and Staff organization of a division. The "command qualities" of the Division Commander, appear to apply so well to commanders of smaller units, even battery commanders, that they are published below.

Qualities essential to the successful exercise of command can be grouped under the two general headings: (1) personal characteristics, (2) professional knowledge and training.

The commander should possess high moral and physical courage. He should be just, upright, and human. He should be honest and frank, yet tactful. He should possess personal magnetism and the quality of eliciting confidence from his subordinates. He should possess good health, a robust physique and a commanding presence. Slovenliness in attire, negligence in obligations, boorishness in manners, and vulgarity in speech are all deficiencies that will impair leadership in a commander much as they do in any of the walks of civil life. The commander should be of generous mind, quick to recognize and acknowledge merit in his subordinates. He should be self-controlled in all situations. He should have confidence in himself and imbue his command with confidence in him. He should be eminently just and absolutely genuine. Nothing can be more inimical to a commander's influence over his subordinates than a prevading sense that he does not believe in himself, is acting a part, a poseur. He must school himself in the habit of straight thinking and of estimating things at their true value. Decisions, the crucial tests of military worth, are founded on reason and judgment which are only the result of the comparison of well weighed ideas. He must possess that quality of marshaling and bending to his own ends the energy and capabilities of others. And above all else, the commander must know his profession.

The habit of command augments both the efficiency of command and the power of leadership. The experienced commander frequently succeeds better than the inexperienced by reason of this fact alone. He has become accustomed to the exercise of command, and exercises it as of right. The manner, the voice, the atmosphere of the commander must carry with it the expectancy of obedience. Without arrogance, egotism, or incivility, he must demand of those he would have support him as if that support were already his. But he should studiously avoid dictation; men of intelligence instinctively resent a dictatorial attitude on the part of a superior, and frequently a suggestion will claim inspired loyalty where autocratic command will result only in disinterested obedience.

The commander should be accessible to his subordinates and should sedulously avoid creating the impression that he is unapproachable. He should constantly bear in mind that no man has so firm a grasp on his business or has attained to such complete understanding as to warrant deafness to the opinions of his subordinates. Nor is this willingness to listen to the opinions of his subordinates necessarily inimical to his authority as a commander or to the unquestioned obedience to his orders which he must exact. Many commanders have, upon occasion, failed of right decision because some subordinate, not with sinister intent but because of instilled force of habit or the instinctive feeling that communications were unwelcome, has held back information which, in frankness, should have been theirs. The commander who inspires his subordinates to speak out ever with frankness, who never upbraids them for faulty opinion, who never ridicules them, who encourages their personal confidences, has a hold on them that is difficult to shake. The commander who listens with consideration to the opinion of a subordinate binds that subordinate to him in the most effective manner.

The commander should always be careful to treat his subordinates with the utmost consideration. Nothing but resentment can spring from inconsiderate treatment, and a subordinate filled with resentment is a sometime laggard, or a disloyal servant.

The commander should never appear in the guise of a fault finder and should discriminate between constructive criticism and petty nagging and fault finding.

Neither is it necessary nor desirable that he should correct every infraction or that disciplinary measures should be imposed for every shortcoming. But when punishments are necessary he should make it plain to the offender that it is not he who punishes, but the law of which he is the representative.

The commander should be quick to recognize merit in his subordinates, and should be constantly on the alert for meritorious cases where reward or commendation should be bestowed. A word of praise or a letter of commendation from the commander himself, not from his representative, has a wonderful phychological effect and is a powerful factor in gaining that influence so essential to command. The more arduous the service the greater the necessity for praise and commendation. The successful commander should understand the phychology of praise.

The commander should be loyal to his subordinates, for no commander can expect loyalty from his subordinates unless he carries conviction of loyalty to them. In leadership there is an inviolable law or reciprocity. The commander must fulfill to his subordinates his obligations. He must be the guardian of their rights, vitally concerned for their welfare, their successes, and their happiness, and sympathetic in their misfortunes. He must guarantee to every man his full rights and exact from every man the full performance of his duty.

Brief Description of Signal Corps Development Projects

By Major L. C. Bender, S. C.

Field and Outpost Wire—Just prior to the formation of the A. E. F., a new type of outpost wire had been developed and furnished organizations which tests had shown superior to wires previously used. Quantity production was obtained during the war but serious criticism from the A. E. F. soon followed because the wire would not maintain its insulation resistance when used for long periods of time as required in stabilized warfare. It became necessary to increase the thickness of rubber wall with consequently increased size and weight of wire to meet this criticism. The French, English, and Germans used wiwre much lighter and smaller than our modified standard which gave satisfactory service but it was made by processes peculiar to the Continent. American wire manufacturers are not equipped to turn out similar wire, could not so equip themselves except at large expense, and are unwilling to assume the burden of such plant additions when the demand is so limited and intermittent. Several of the largest of these producers have attempted to obtain equivalent results by variations of their processes but without success. All have virtually given up finding a solution for the problem save one who has recently submitted a very promising sample. Close contact is being maintained with this one and tests are under way of his product. The process used is peculiar to this one manufacturer, is patented, and even if entirely successful, competition and large quantity production for emergency may still be lacking. But if any American manufacturer can make a wire meeting the requirements, it will be an advance over present conditions.

Field Telephone—There are three types of field telephones now authorized for issue: i. e.—the EE-5 which is the commercial product (1375B) of the Western Electric Company used by Field Artillery and Cavalry; the EE-4 commonly known as the camp telephone Model A, and the EE-3 similar to the EE-4 but having a signal buzzer in addition. The latter two are used by all other services. The ideal is to provide a single type of telephone for all purposes. It has not been possible to accomplish that end due to the legitimate differences existing in

the type of transmitter and receiver needed by the services. It has been possible, however, to design a single type of box containing all the apparatus except transmitter and receiver so that any type of transmitter and receiver (head set, hand set, breast transmitter, etc.,) can be supplied, carried in a pouch on the carrying strap and quickly connected for use by means of plugs and jacks. This model known as the EE-8 has been under trial by all the service boards and will soon be again submitted after completion of what is hoped will prove the final modification to meet objections by these Boards.

Sound Ranging for Artillery—Near the close of the war, the Bureau of Standards devised a system of sound ranging to determine the position of hostile artillery based on the use of sensitive telephone transmitters as outpost listeners instead of the heated grid outpost of the Bull-Tucker system used during the war. Record was made on a smoked cylinder instead of a photographic film. A redesign has been produced which embodies the best features of both systems. It uses microphones of improved design as the listeners, an improved high speed camera for recording, and a redesigned control switchboard. The new design extends the possible distance between control switchboard and listeners by three or reduces in the same ratio the weight of wire required for a given distance. Successful operation has been demonstrated at Aberdeen Proving Ground and Camp Eustis, Va., during the past year. Slight modifications have been completed at the suggestion of the Coast Artillery Board and the equipment goes to Camp Eustis again about April first for further service use.

Time Interval Apparatus—The time interval apparatus employed in fixed fortifications is not suitable for use by mobile heavy artillery units and a compact design for this purpose was undertaken at request of the Coast Artillery Board. Two models were constructed and submitted for trial some months back. One employed a novel form of clock with mechanical power amplifier as the motive power and the other a motor with automatic speed governor driven from a storage battery. Although the former was the more accurate of the two, the Board expressed a preference for the motor driven apparatus on account of the ease with which the time intervals could be varied by control of speed, this feature having some promise as a simple means of applying fire corrections. A second motor driven set is being constructed using a better motor, having a wider variety of time intervals, and means for applying the time signal to the telephone circuit to avoid the necessity for special time interval circuits. This model will shortly be ready for further trial.

Monocord Switchboards—At the close of the war, a survey of equipment then used was made and officers with field experience in the A. E. F. agreed that the 4, 8, and 12-line monocord switchboards could be materially improved in design. The new features included omission of the fuses and lightning arrestors, front connected cords instead of rear connected and units secured by knurled screws instead of machine screws. Models of the new design were made but due to the large stock of the older design on hand, were not submitted for service trials. Recently they have received such trials with the result that two of the three supposed improvements incorporated have been unfavorably received and a compromise design apparently will result. The operator's unit (also an A. E. F. recommendation) designed for use with these switchboards will probably also be abandoned and recourse had to the original plan of using a field telephone for the operator's set. A proposal that the switchboards be supplied normally

with cable attached and terminated on a terminal strip has met favor and the next model will be submitted for trial in that form.

Fire Control System for Fortifications—For several years the Coast Artillery Board has been active in investigation of fire control communication systems in fortifications to make them more nearly comparable in service rendered with modern commercial telephone practice. The chief difficulty lay in the fact that although the common battery telephone system was quite adequate at the time it was installed in fortifications, the constantly increasing range of armament has made it necessary in many cases to extend base line to a point where common battery transmission is no longer feasible. Some other features of the system are also susceptible of improvement, chiefly the telephone head sets, the time interval systems, and provision for emergency operation. There is little doubt but that the improvements in mind can be readily attained but the installation of a demonstration system is considered desirable if not essential before definitely adopting any new type. A fortification affording opportunity for the effective demonstration of the improved type is being sought, and upon final determination of the site, the installation of the model system can proceed.

Signal Panels—A Board of Officers convened by War Department Order has recently been studying the subject of identification and signal panels for use of headquarters in the field in communicating with aircraft. Many different codes for this purpose have been worked up independently by organizations in the field and this Board was created to determine the best system which might be generally used. As the result of this Board's work, which has recently received the approval of the War Department, it became necessary to revise in several respects, existing specifications for panels not only in color but in shape. That work is now under way.

Sound Ranging for Naval Targets—At the close of the world war the Coast Artillery took over from the Navy Department a project, looking toward the development of a method for locating underwater craft which for any reason could not be seen from shore, by under-water sound detection. The Coast Artillery continued this work, first at Boston and later at Fort H. G. Wright, New York, until 1921, when the Signal Corps was charged with the technical development and the Coast Artillery continued with the tactical development. The two branches have since that date cooperated in the work at Fort H. G. Wright, New York. Two distinct uses for this equipment are in mind: First—as an aid to spotting and adjusting our own Artillery fire; Second—as a means for continuously tracking Naval targets under way. Encouraging results have been obtained in the use of this apparatus but its development cannot be considered to be completed. A new design of hydrophone station and shore compensator are under way which it is expected will materially improve the value of this equipment.

Scr-136 Set—This is the last of three aircraft sets and two ground sets for air to ground communication and vice versa which the Air Service and Artillery asked be developed about four years ago. It is a ground set having means for telephone, interrupted C. W., and pure C. W. transmission and reception. The range by telephone from ground to plane is 30 miles. A gas engine driven generator is the source of transmitter power supply. The development is practically complete and a model is receiving its final laboratory tests before submission for service tests.

UNI-DIRECTIONAL RECEIVER FOR PERMANENT RADIO STATIONS—The constantly increasing number of radio stations in daily operation for traffic and the definitely limited number of working frequencies available for assignment to such stations, makes it increasingly difficult to operate such stations without undue interference from other stations. Some relief will result if a receiver can be developed which will be responsive to radio energy coming from one direction only, excluding it from all other directions. Preliminary investigation indicates the possibility of developing such apparatus and following detailed study of the subject, a model of such a receiver is under construction. This apparatus will be limited in its application for the present, to permanent radio stations of the army net.

IMPROVED PORTABLE STORAGE BATTERY—The increasing use of moulded rubber containers for portable storage batteries used for automobile and radio work has suggested the possibility of using them to advantage for all field operations of the army. A limited number of such batteries using the elements of the BB-28 type were recently made up for us by a manufacturer and have been examined and made the basis of reports by the Signal Corps, Field Artillery and Coast Artillery Boards. The consensus of opinion was that the batteries were superior to the standard BB-28 type in that both weight and space were reduced together with probable lower maintenance by avoiding the destructive action of acid on the former wood containers. The design of detachable cover furnished and some other details were not acceptable. Additional batteries incorporating most of the detailed recommendations of the Boards will be obtained in the near future and again submitted to all Service Boards for report.

RADIO EPUIPMENT FOR MINE PLANTERS AND HARBOR VESSELS—The vessels of the Coast Artillery used in harbor defense are still equipped with spark transmitters. It is recognized that these are now obsolete and the Coast Artillery Board has recently outlined a program concurred in by the Signal Corps for the ultimate replacement of all its radio equipment with modern continuous wave equipment. The program includes mine planters, cable ships, harbor tugs and D. B. boats. Two different types of transmitters have already been furnished the Coast Artillery Board to determine their suitability on mine planters and cable ships. These were not thoroughly satisfactory and a third more promising type is now being obtained for that purpose. It is planned to use the SCR-109 A set on harbor tugs and also as a telephone set on mine planters. A trial will shortly be made of the SCR-133 set on a D. B. boat. This set was designed for aircraft use and is already in production. With slight alterations it is believed suitable for D. B. boats also.

RADIO FOR DIVISION NET. (15 MILES)—It is proposed to develop a set similar to the SCR-131 but having three times its range. This would normally be used between brigade and division headquarters and between certain larger headquarters of Artillery units. Its design has not yet been undertaken but it is contemplated to copy as nearly as possible the design of the SCR-131 in order that the methods of operation may be similar and the training problem thereby minimized.

PORTABLE ANTENNA SYSTEM FOR SCR-132 SET. Many forms of portable field antenna and supports therefor have been considered for use with the SCR-132 set, and several have been erected for trial. It has been finally decided to use an 80 foot metal mast supporting an umbrella antenna, the mast being of a new design which is assembled on the ground and raised with the minimum amount of special

apparatus and few men. It has been found that four men are sufficient to assemble, raise and lower this mast and antenna in a reasonable length of time. It has not been definitely determined whether a steel mast or a duralumin mast will be employed. One of each type is being made for further examination and trial. The only advantage of the duralumin mast would be its lighter weight, which is a factor in transportation.

History Repeats

Lieutenant Commander O. C. Badger, United States Navy, writes in the May, 1925, issue of the United States Naval Institute Proceedings, a most interesting article on "The Application of Lessons of History on a National Problem of Today." He states that at the time of the invention of the torpedo Great Britain and France maintained the most powerful navies in the world and that its invention created great discussion in those countries as to its influence on future warfare. Monsieur M. G. Charmes, whose writings were published in all of the great national and daily periodicals of France, was convinced that the torpedo had doomed the warship. He wrote:

> The torpedo will surely triumph over the ironclad, and modern fleets will be consigned to the Naval Museum of the Louvre by the revolution that torpedo warfare will bring about. Unquestionably armor has been vanquished not by the gun but by the torpedo."
>
> In dealing a mortal blow to the ironclad the advent of the automobile torpedo at once puts an end to the race which has for many years, gone on between the ironclad and its guns."

His writings so influenced the French nation that they largely discontinued the construction of battleships and concentrated on torpedo boats. England, however, continued her building program and as a result maintained the unquestioned supremacy of the seas. The author states that in 1888 France possessed 134 torpedo boats and eight destroyers, without even threatening Britain's naval supremacy.

The author writes regarding the British efforts to offset the power of the torpedo: "Out of the British effort was originated the present day means of effecting protection against the torpedo craft. They provided sufficient torpedo boat destroyers to guard the fleet and, if opportunity offered, to launch an offensive torpedo attack. They altered the hull design of heavy ships, providing them with numerous bulkheads and compartments. They developed and provided a breech-loading, rapid fire gun capable of being easily, quickly and efficiently handled."

At another point in his discussion he states: "Controversies of national and international importance have arisen in modern times over the invention or development of the frigate, the steam ram, the torpedo boat and the submarine. In each case the ship-of-the-line has been doomed by mistaken enthusiasts for national defense nostrums. In each case important modifications and methods have resulted. But because each of the smaller weapons has been restricted by its own limitations, the capital ship has continued as the pinnacle of sea power," and "The French proponents of the torpedo, in their enthusiasm, refused to acknowledge the efficacy of any proposed means of defense against that weapon. Because they did not experiment, with equal diligence, on developing such defense, none satisfactory was evolved. This resulted in the torpedo appearing to be more invincible than was actually the case."

Through his discussion of the advent of the torpedo the author shows that the same type of controversy existed then as has existed recently over the powers and limitations of aircraft. In this regard he makes the following refreshing statement: "At the present time, in reference to the airplane, no one-sided development must be permitted to bring about a blinding effect on the possibilities of the future. After all, it is cheaper to build up the necessary means of defense during times of peace than to wait until the urgency of war imposes such requirements. If, after thorough and sincere trial, the national resources fail to produce adequate means of defense, then, and not until then, are we safe in committing the safety of the nation to the new weapon. For these reasons, when broad claims for strong offensive power are made by any class of enthusiasts these same enthusiasts fail in their duty if they do not seek to provide equally strong defensive power."

A Courageous Action

Major General Summerall, Commanding the Second Corps Area, has recently had published a General Order which reads as follows:

HEADQUARTERS SECOND CORPS AREA
Governors Island, New York

April 25, 1925.

General Orders
No. 15

The Commanding General desires to commend publically Second Lieutenant Saverio H. Savini, 7th Coast Artillery, for his unhesitating and courageous action in saving a child from drowning in the waters of Sandy Hook Bay at about 11:30 a. m., March 6, 1925.

Upon discovering that the three year old son of First Lieutenant E. W. Timberlake, 7th Coast Artillery, was drowning, Lieutenant Savini without hesitation ran about 200 yards to the waters' edge, removed only his overcoat and in full uniform plunged into the icy water. In the intense cold he swam out 90 yards to the child and through the drifting ice brought him safely to the shore, thereby exemplifying that courageous spirit which produces instant mental and physical response to a call of duty that has always distinguished the Army. Had it not been for Lieutenant Savini's prompt and unselfish act without regard to personal consequences the small child would undoubtedly have drowned.

The Commanding General considers this superb performance worthy of the high traditions of the Army, exhibiting a presence of mind, degree of self sacrifice and high courage that reflects great credit upon Lieutenant Savini as well as the Army, which is proud to number him as one of it and worthy of emulation.

This order will be read to the assembled troops at each post, camp and station at the first formation after receipt.

(201 AGO-Off. Div.)

By command of Major General SUMMERALL:

W. P. JACKSON,
Colonel, General Staff,
Chief of Staff.

OFFICIAL
L. S. CHAPPELEAR,
Lieut. Colonel, Adjutant General's Department,
Adjutant General.

MILITARY NOTES

furnished by

THE MILITARY INTELLIGENCE DIVISION, G. S.

Morocco

FRENCH AND SPANISH MILITARY ORGANIZATIONS—French and Spanish efforts towards the pacification of Morocco have been so featured in the newspapers for the past six months that it may be of interest to see just how each country has organized its forces to combat the warlike Riff tribes led by their capable leader Abd-el-Krim.

At present, Spain maintains four strongly garrisoned posts in her zone which stretches from the mouth of the Moulouya River, on the Mediterranean east to Melilla, to south of Larache on the Atlantic. These four posts are Melilla, Tetuan, and Ceuta on the Mediterranean and Larache.

The organization of the Spanish Colonial army in Morocco was published in Madrid on March 26, 1925, as follows:

Resume, Spanish Troops

	Officers	*Men*	*Animals*
Infantry	1,200	39,159	6,644
Cavalry	159	3,523	2,858
Artillery	333	10,380	4,257
Engineers	186	7,347	1,369
Q. M. Corps	73	3,301	1,931
Medical Department	132	2,252	655
Veterinary	73		
Chaplains	33		
G. S. (Topographic, etc.)		49	
Sea (Stevedores) Cos.		488	
Aviation	56	415	
Totals	2,245	66,914	17,714

In addition to the above, 381 officers and assimilated personnel from different Arms, and 63 clerks are also attached to the administration of the protectorate.

Native Troops

5 Groups of "Regulares."

	Officers	*Enlisted Inf.*	*Enlisted Cav.*	*Animals*
Prescribed strength	458	10,876	2,180	3,871

5 Groups of "Mehal-la Jalifiana."
Strength: varying according to circumstances, but usually, from 500 to 1000 enlisted per group.

When the organization of her permanent army in Morocco is completed, Spain will have about 65,000 Spanish troops and some 15,000 native troops in all.

It is interesting to note that Spain relies almost entirely on her own nationals for this trying military service, the proportion of native troops being about one to four Spaniards in the zone.

France, on the other hand, reverses this proportion in the Protectorate.

At the beginning of 1924, the strength of the Corps of Occupation in Morocco was about 65,000 men. This comprised 55,000 men of the regular forces as follows: 43 Battalions of Infantry; 16 Squadrons (really troops) of Cavalry; 2 Squadrons of Cavalry Armoured Cars; 22 Batteries of Artillery; 10 Air Squadrons.

Of the above only 7 of the 43 Battalions of Infantry were French Battalions, and, of the 7 French, 4 were Zouave, which really serve only as depots for the instruction of the French noncommissioned personnel of the native troops. They do no fighting. The other three French battalions are the African battalions, penal battalions, which may serve only in Africa. Of the remaining 36 battalions, 9 are Foreign Legion and 27 are natives—Moroccan, Algerian, Tunisian and Senegalese—but all Regular Army.

The other 10,000 men are included in one of three distinct categories: 1—Mixed Goums of Morocco; 2—Maghzen, Mehallas of the region of Marrekech; 3—Partisans.

There are also being organized two Saharan companies. These native troops are peculiar to Morocco. The Goums were formed to circumvent the Treaty of Algeciros by the terms of which Germany would have claimed France was usurping the authority of the Sultan if she had raised regular troops as she had done in Algeria. They were local police forces which, in reality, rendered the same service as did regular troops and did it so well that even with the German mortgage lifted, and in spite of the consequent enlistment of Moroccan spahis and riflemen, the mixed Goums have been retained. There are now 27 of them—each consisting of three-quarters of infantry and one-quarter cavalry, officered by French officers of the Information Service and with French or experienced natives of the regular army as noncommissioned officers. Unlike the other irregular troops, they wear in part French army uniform, notably breeches.

The Maghzen are permanent troops of infantry and cavalry under the orders of the officers of the Information Service. Their strength, never very great, varies according to the posts and regions where they are employed. Unlike the Goums, they have no French officers or N. C. O.'s, and obey directly a native leader. Their job is to assure the police and security of the post to which they are assigned, to make patrols and to protect convoys and escorts.

The Mehallas are semi-permanent forces of infantry and cavalry, with no French officers or N. C. O.'s, which are recruited when needed by the great Caids of the South (Marrakech) under the control of the officers of the Information Service. They are all that remains of the Moroccan armies of former times.

The Partisans, on the other hand, are in no way permanent, but are the horsemen and foot-soldiers of the friendly tribes who volunteer to take part in any determined military action during a comparatively short period. For this they receive a daily pay, a rifle and some cartridges. In combat they are directed by the particular officer of the Information Service who is assigned to their tribe.

The difficulties of the operations in Morocco can be visualized by quoting from an account given by an officer on the Staff of the French Resident General, Marshal Lyautey:

"Our first contacts with the natives were decisive, great hordes coming out, at the call of a marabout, from the most distant tribes, confident in his power to

annihilate us and counteract any effort of our arms, hurling themselves in dense masses against our cannon and machine-guns. At Djorf, in 1903, at Sidi-Bou-Athmane in 1912, while General Mangin was marching on Marrekech, the victory was immediate and complete.

"Those happy days have passed!"

"The Berbers now know the force of our arms; they have, in a marvelous manner, applied their manner of fighting to their own warlike habits and to the terrain which they are defending.

"As to their warlike qualities, an absolute disregard for danger, alertness, physical vigor, as well as a surprising ability to maneuver on all kinds of terrain, an instinctive knowledge of surprise attack, cleverness in discovering the weaknesses of the adversary and in taking immediate advantage of them, are some of the most manifest. Their contempt for danger, warlike zeal—all who have served in Morocco can testify to these qualities.

"Their physical vigor is most extraordinary under all circumstances; whether their faces are torn by the 'siroco' and burning sand, as was true at Skoura in 1918, or whether it be a raging snow-blizzard lashing their half-naked bodies, as through the bitter night of the 'Aouinettes' in 1913, or yet being beaten down by the hailstones of such an icy deluge as was experienced at Bou-Arfa last May. The endurance of the 'Djicheurs' in descending the slopes of the Atlas in the heat of summer to scour the Sahara seems a feat almost supernatural to us of the civilized but more anemic races.

"Their ability to operate on any terrain is almost unbelievable. In 1913 at Ras Amras, a guard detachment which had just completed an hour's hard climb to the peak it had been ordered to occupy, observed the Chleuhs down in the valley and continued to fortify themselves rather at their ease, thinking they had an hour to spare; a quarter of an hour afterward they were attacked in hand to hand conflict by those same Chleuhs!

"From his early childhood the chief ambition of the young Berber is to become strong and artful. This is most natural, for he learns early in youth, from observation of his surroundings, that life for him will be one perpetual struggle for the 'survival of the fittest'—night and day the Berber stands guard against his hostile neighbor of the neighboring tribe. Thus, he follows his father and brothers to the hunt—even to war; very young he rides horseback; at the first opportunity he buys a rifle—or more probably, steals one—the very folk songs chanted by the women of the tribe at night under the tents impress deeply into his mind that he can not be worthy of being called a man until his exploits and acts of bravery and valor shall have been recognized and chanted by the womenfolk, as they are now singing the deeds of his ancestors. In the eyes of the Chleuhs, the action of theft under arms is an accomplishment worthy of great honor, admiration and esteem; so the young Berber longs and seeks the first chance to try his skill. He soon takes part in one of the customery undertakings of his tribe, known as the 'rezzou,' organized to annoy the neighboring tribe, or still another operation known as the 'djich,' the motive of which is to take by surprise the French trains, labor parties or other small detachments. This innate thirst for plunder is one primary reason why the French recognize the advisability, in order to get along peaceably with the Chleuhs, of respecting the lands of these unruly tribes. Unless such a policy were adopted, a continuous attack by night and day by hordes of them would result; the French posts, convoys and communications would be in constant danger.

"In spite of all this, these incorrigible thieves seem to have a character which contains certain noble traits. For instance, they observe scrupulously certain

time-honored traditions—and, strange to say, keep their word. They have a clear understanding of the rules of hospitality which they respect warm-heartedly. If we go back to the early part of the Middle Ages, we will discover curious resemblances, even in looks, between these mountaineers of the Moroccan Atlas and the men who have become the world's models of chivalry.

"But let us follow the fortunes of a force which, with the object of taking over new territory, proposes to build an advanced camp. The enemy spies give the alarm. In a flash fires are kindled calling out the warriors who rush from their 'douars'; the foot-soldiers jump into the saddles with the cavalrymen or hang onto the tails of the horses; far back in the mountains, the sound of our cannon will bring out the others; it is the 'Call to Arms.' In a short time a curtain of sharp-shooters is formed; up on the crests, at the mouths of the ravines, they hide themselves awaiting the coming of the advance guard. The sun, the dust and the winter tempest have given to the clothing and skin of these fighters the very color of the ground they are defending—and they seem to melt into it. Woe to the band of invaders that is too weak or too dispersed, or which arrives out of breath or in disorder and dares to venture beyond the protection of its neighbors or out of sight of its artillery—in a flash the alarm announces their approach and, from all sides, the war-cry of the Berber rings out: 'Aoura, Aoura!' (Come on! Come on!)—and, out of tiny ravines, out from behind every imaginable shelter, the assailants filter down upon their victims with almost unbelievable rapidity. A few seconds and the firing begins, becoming more and more intense and close up, until it comes to a hand-to-hand conflict.

"But the signal has likewise been given to the French forces, and artillery shells and machine-gun bullets rain down on the enemy, who disappear at once as rapidly as they had appeared, carrying off their wounded and their dead—but also a quantity of French arms and munitions. Sometimes the line drawing back gives up a little ground in so doing, but not without continuing the firing, until the terrain is sufficiently favorable to warrant a counter-attack which they undertake in fury.

"It is against the flanks of a moving detachment, and to the rear, that they find their best opportunity to make trouble, so consequently most of them go in that direction. They come in swarms to harass the flank-guards; a summit is scarcely evacuated by the last echelon before it is covered by the sharp-shooters who have been, up to this moment, dispersed around about, all in spite of a veritable shower of shells. Having been so scattered about in the bushes and behind rocks, no definite objective was offered to the artillery, whereas the sharp-shooters, once having thus gained the summit and profiting by the facilities of adjusting their range, snipe off the cavalrymen and the infantry platoons still in movement. Everywhere the instant a vacant position is spotted, they swarm in to encircle it, taking advantage of every natural vantage point, and gradually coming nearer to their coveted prey, the main guard slowly moving along down in the valley below.

"And if, by chance, the French column reverses its direction of march, if, in any way, the new direction which they may have taken can be construed by their desperate assailants as a retreat, their warlike fury reaches a degree hard to comprehend. Their attack becomes really maddening; urged on by the shrieking of their womenfolk, all of them, even any who before may have been somewhat hesitant, appear all around the horizon; onward, through the rain of machine-gun fire and shells they rush, wedging in and out through the underbrush and rocks until they are right up onto the French units already hampered by

having to carry their dead, whom they must preserve from mutilation, and their wounded whom they must save. In 1914, at El Herri, an entire French column was thus almost totally annihilated.

"Once the French, despite all of this, have reached their objective, and have proceeded to set up camp, the assailants lose no time in harassing them by constant fire while they are digging their trenches or erecting their shelters. This accomplished, they post a number of guards to spy over the French while the rest retire to the 'douar' to eat, care for their wounded, admire the trophies they have won, and boast to the women of the tribe of the valor of heir exploits. For this they do not lack an audience, their women being indeed numerous—real vixens, active, shrewd and warlike, having themselves followed up the men in battle to cheer them on, offer them drink, rob the enemy dead and wounded, as well as to lend a hand in carrying off their own dead, honor forbidding that they be left to lie on the field. They are constantly on the watch during the conflict to detect any sign of cowardice on the part of one of their men, which, if discovered—an event most rare—makes them use every effort to cover him with ignominy and shame.

"At dusk the most stubborn fighters return—they attempt no longer to attack the camps themselves, too well defended by a network of barbed wire, illuminated by torches and well flanked by automatic weapons, but they send in heavy volleys and often kill or wound quite a number of men and animals. Others are bold enough even to creep under the wire and strangle a sentinel or to cut the strap attaching the rifle to the wrist of a soldier asleep in his tent, making away with the weapon despite the violent fusillade loosed after them.

"The following days, native posts and lookouts are established; these spy unceasingly every movement of the French from all sides, holding themselves ready to take advantage of the slightest inattention on the part of the French, to spring down on their convoys, their labor parties, animals at water, etc. In France one too often hears officers expressing astonishment over the size of the losses: 'how can this be possible, when you consider that we are fighting with cannon and machine-guns against an enemy equipped only with rifles?' they say. They forget that, when a moving column has operated during an entire day on an almost impossible terrain, playing the role of a 'bull tormented by wasps,' it is not surprising if, at nightfall, a goodly number of stings have been received."

Japan

Military Training Begins in Japan's Public Schools—In April, 1925, the Japanese Official Gazette published the Students Preliminary Military Training Act together with the Joint Order of the Departments of War and Education giving rules for putting this Act into immediate effect.

This brings to a successful consummation the efforts of the officials of the Japanese War Department to place army officers in the higher grades of the public schools to enforce drill among the students. There is no doubt that the example of the Reserve Officers Training Corps in the United States to some extent influenced the Japanese War Department. The passage of the Army Reform Bill in the last session of the Diet, whereby four regular divisions are abolished, provides the funds necessary as well as supplies the officers for enforcing this training. While several hundred Japanese officers, chiefly in the higher grades, will probably be forcibly retired, about 1200 of the company and field ranks will be detailed as instructors in the public schools.

In the Japanese school system the elementary school extends over the first six years. The next five years' work is logically covered in the middle school, and this is followed by a three years' course in high school before reaching the college or university. However, above the elementary school, are numerous normal, technical and business schools attended by many students who do not go to the regular middle or high schools.

In the year 1920-1921 there were 10,435,000 students in Japanese schools. Of these about 8,633,000 were in the elementary schools and 70,000 in the colleges and universities. An examination of the new law, in the light of statistics, indicates that probably about 400,000 male students generally between fourteen and twenty-two years of age, will be compelled to take military training in the schools and about 170,000 more may voluntarily do so.

Article I of the new Students' Training Act reads as follows: "In order to take charge of the drill of the male students in the following *public* schools, Military Officers on the Active List will be attached to the following institutions: Normal Schools; Middle Schools; Business Schools; High Schools; Technical Schools; College Preparatory Schools; Middle School Instructors' Training Schools; Higher Normal Schools; Business School-teachers Training Schools; and Supplementary Business School-teachers Training Schools.

"The service may be omitted in time of war, in time of emergencies, or under any other unavoidable circumstances.

"The assignment of military officers as specified in the preceding article will be decided at conferences between the Minister of War and the Minister of Education. The military officers attached to the foregoing institutions will receive instruction from the principals of the schools concerned in regard to the training of the students."

Article 2 reads as follows: "In order to take charge of the drill of the male students in the following *private* schools, military officers on the Active List *may be* attached to each institution on *application*. Middle Schools; Business Schools; High Schools; College Preparatory Schools; Technical Schools; Other private schools especially officially recognized.

"Article 1 will apply to the case where military officers are attached in accordance with Article 2.

"Military officers on the Active List *may be* attached to different *colleges* in accordance with the preceding two provisions, on application."

One article provides for inspections of the training by army officers under orders of the Minister of War and another limits the application in business schools to those whose graduates have the equivalent of eleven years' schooling.

Under the Joint Order of the Departments of War and Education, the form of application for training by private schools is prescribed, and the cancellation of this training directed when the standing of the school is not officially recognized or when training indicates unsatisfactory results.

As yet the War Department has not made known how much credit is to be given the students taking military training in the schools when they are called to the colors.

Reduction of Number of Divisions—The Japanese Official Gazette under date of April 8, 1925, announces the new station list of the Japanese Army which will hereafter apply. As a part of the Army Reform Program approved at the last session of the Diet, four complete divisions, each of two infantry brigades of two regiments each, a field artillery regiment, a cavalry regiment, an engineer battalion, and a transport battalion have thus been abolished. At the same time

16 regimental district headquarters, four garrison hospitals and one remount unit are given up.

This should affect the number of officers and men serving with the colors by about 35,000. The actual reduction however, will hardly be as great. Among about 1900 officers affected, it is reported that at least 1200 of the company and field officers' grades are to be used in introducing military training in the public schools above the elementary grade and in certain private schools.

Increases in the services of aviation, antiaircraft, tanks, etc., will within the next few years, require from 300 to 500 additional officers. Many of these will be obtained by retaining in service officers who would otherwise be discharged. Undoubtedly a number of extra officers can be used with the units remaining and the actual reduction in officer personnel will not exceed a few hundred, chiefly in the field and general grades.

Under the present programs for increases in aviation, antiaircraft and tanks, it seems probable that about 5000 enlisted men will be added to the Japanese Army during the coming five years. For the present, however, only a thousand or so of the 33,000 taken from the divisions are liable to be retained in service. Thus the actual numerical reduction in the present Japanese active army is only a little over 30,000 officers and men.

In selecting the divisions to be eliminated, the Japanese War Department was confronted with considerable political pressure on the part of Diet members from the areas most likely to be affected. However, the final selection and adjustment shows rare judgment, and careful consideration of historical and hence morale conditions, as well as shifting of population.

The Japanese Active Army in the war with Russia had a 13-division organization. Following this war a program of reorganization was started and completed about 1908 whereby the Japanese Army consisted of 19 divisions, 18 being territorial, and the Guards divisions. The present two divisions for Korea were authorized in 1916.

In the present shift the division for Korea (19th and 20th) remain unchanged. The four to be eliminated from the six created following the war with Russia and leaves 14 territorial and the Guards division in Japan. Of these 15 home divisions, only four—the Guards and 1st Divisions of Tokyo, the 4th Division of Osaka and the 7th Division of Hokkaido are unaffected. The remaining eleven division changes are generally made by abolishing the newest regiments and replacing them by the regiments in these divisions at the time of the war with Russia which had been given later to the four divisions now eliminated. Thus the 2nd, 3rd, 5th, 8th, 9th, and 10th divisions, after nearly twenty years of change, now have the same regiments with which they fought Japan's major war and the changes in the other five divisions, two of which were created since the war with Russia, are as slight as possible.

The four divisions given up (the 13th, 15th, 17th and 18th) are all rural divisions, thus showing evidence of the distinct city movement of population in Japan in the past twenty years. The 13th (Takata) Division was stationed in territory bordering on the Sea of Japan. The 15th (Toyohashi) Division was stationed between Tokyo and Nagoya. The 17th (Okayama) Division occupied a portion of the area between the Inland Sea and the Sea of Japan. The 18th (Kurume) Division was one of three divisions stationed on the Island of Kyushu.

The two youngest divisions not to be abandoned are the 14th (Utsunomiya) Division occupying the region near but north of Tokyo and the 16th (Kyoto) Division stationed in and near Kyoto.

Undoubtedly the lessening of morale naturally expected as a result of so great a reduction and shifting in organization as has been here effected, is very slight, and the people and conscript soldiers will soon become accustomed to the changes made.

Italy

Air Strength of Powers—The Engineering Division of the Italian Air Service recently published the following comparative chart showing the air strength of France, Italy, the United States and Great Britian.

	Number of Planes						Grand Total
	Airplanes			Seaplanes			
	Pursuit	Observation	Bombardment	Pursuit	Observation	Bombardment	
France	750 (50 sq.)	756 (63 sq.)	336 (28 sq.)	12 (1 sq.)	48 (4 sq.)	36 (3 sq.)	*1938* (149 sq.) Appropriation 1924/25 820,000,000 Italian Lire =$34,167,500.
Italy 30/6/25	486 (27 sq.)	314 (24 sq.)	213 (22 sq.)	84 (6 sq.)	196 (14 sq.)	18 (3 sq).	*1311* (95 sq). Appropriation 1924/25 500,000,000 Italian Lire =$20,833,333.
United States	201 (14 sq.)	320 (25 sq.)	162 (16 sq.)	99 (8 sq.)	111 (9 sq.	105 (9 sq.)	*998* (81 sq.) Appropriation 1924/25 1,920,000,000 Italian Lire =$80,000,000.
England	216 (17 sq).	240 (20 sq.)	153 (15 sq.)	54 (4 sq.)	77 (6 sq.)	15 (2 sq.)	*755* (64 sq.) Appropriation 1924/25 1,800,000,000 Italian Lire =$75,000,000.

COAST ARTILLERY BOARD NOTES

Communications relating to the development or improvement in methods or materiel for the Coast Artillery will be welcome from any member of the Corps or of the service at large. These communications, with models or drawings of devices proposed, may be sent direct to the Coast Artillery Board, Fort Monroe, Virginia, and will receive careful consideration.—R. S. ABERNETHY, *Colonel, C. A. C., President Coast Artillery Board.*

New Projects Initiated During the Month of May

Project No. 345, Gray Antiaircraft Machine Gun Sight—This sight is being developed by the Ordnance Department. When manufactured, one each of the Cal. .30 and Cal. .50 sights will be sent to the Coast Artillery Board for test.

Project No. 346, Information of Recent Developments in Methods and Materiel (Sound Ranging)—This project is confidential and will not be published.

Project No. 347, Cowen Graphic Method of Fire Adjustment—A rapid graphic method of fire adjustment by means of a master chart and grids. Submitted by 1st Lieut. Edward G. Cowen, 92nd Coast Artillery, and now being tested by the 51st Coast Artillery at Fort Eustis, Va., under the supervision of the Coast Artillery Board.

Project No. 348, Test of Compasses—Referred to the Coast Artillery Board for study and recommendations with reference to standardization upon two types of compasses only, and the characteristics desired in each type. The Board in its report recommended standardization upon two types only—a cheap type for issue to certain Coast Artillery personnel serving with mobile artillery for route finding in marching, or preliminary reconnaissance. As a rule, this type is not required by Coast Artillery personnel assigned to fixed harbor defense and antiaircraft batteries. The accurate compass to be of the prismatic type for use as indicated in Paragraphs 1-6, T. R. 435-325. The recommendations of the Coast Artillery Board were approved by the Chief of Coast Artillery.

Project No. 349, Hearn Ballistic Computer—This device was proposed by Captain (now Colonel) Clint C. Hearn, Coast Artillery Corps, in 1904. At that time it was recommended by the Artillery Board that an allotment of funds be made for the construction of one of the devices and that it be sent to Fort Monroe for test. The Commanding Officer, Frankford Arsenal, on February 7, 1905, submitted an estimate to the Chief of Ordnance covering the cost of manufacture of the device—$1044.60. The Artillery Board in its proceedings of March 17, 1905, stated, "If each instrument is to cost this amount ($1044.60) the Artillery Board is of the opinion that the value of the instrument does not justify the expenditure. If single instruments after the first can be constructed at a reason-

able cost, say approximately $125.00, it is thought advisable to complete the first one for test, and the Board recommends, in such case, that the additional allotment be made." Available records show no further action taken in the matter until March 19, 1925, when a letter was written by Colonel Hearn suggesting that the subject be reopened at this time. The matter was accordingly referred to the Coast Artillery Board for consideration and report.

The Coast Artillery Board has studied the device and among other conclusions drawn decided "That the military value of the device did not warrant its manufacture." The report of the Board has received the approval of the Chief of Coast Artillery.

Project No. 350, Supply of Fire Control Charts and Equipment—This is a continuing project and covers the supply of charts (blue prints and brown prints) by the Coast Artillery Board to Coast Defenses, mobile artillery regiments, National Guard Coast Artillery organizations, Reserve Officers Training Corps Units of Coast Artillery.

Project No. 351, Firing Lanyard for 16-inch Howitzer Carriage Model 1920—Firing lanyard for the 16-inch howitzers at Fort Story installed, tested, and found satisfactory with minor modifications.

Project No. 352, Rectangular Coordinate Method of Fire Control—Method proposed by Lieutenant William D. Hohenthal, C. A. C. Under study by the Coast Artillery Board in connection with Project No. 86—"Rectangular Coordinate Slide Rule (Helmer)."

Project No. 353, Study of Antiaircraft Target Practice Reports Panama Coast Artillery District, 1923-1924—Being studied by the Coast Artillery Board, special attention being given to the following:

a. The reporting of aerial spots by "Polar Coordinates."

b. The value of "Fire Adjustment Boards."

c. The separation of "Corrections of the Moment" from "Muzzle Velocity Corrections."

Project No. 354, Test of 3-inch Antiaircraft Gun Sighting System—Test to be made on both the 1917 MI gun and the 1923 E gun.

Completed Projects

Project No. 327, Conditions of Fire at High Speed Targets—

I—History of the Project.

1. In connection with the present development of position finding and fire control the Coast Artillery believes it desirable, so far as may be practicable, to calculate the effect of the approximate assumptions and methods used in position finding upon the accuracy of the firing data when applied to targets moving at 25 and 30 knots.

2. To present this situation broadly, several different directions of travel have been considered, that is, in direction of plane of fire, at 30° to plane of fire, at 45° and at 60°.

3. The arms considered were the 16-inch barbette rifle, the 14-inch rifle, the 12-inch mortar and the 12-inch rifle on barbette carriage, model of 1917. Case II and Case III firing were considered for guns. These are considered at several different elevations.

4. The erroneous assumptions usually applied in service are the following:

a. On plotting board; time of flight for predicted travel of target taken to correspond to last setforward point.

b. On range correction board; Ruler set at map range of last preceding set forward point.

(1) Flat correction in yards.

(2) Correction in per cent.

c. On deflection board: Use of corrected range of last preceding setforward point. NOTE: This is usually necessary because present practice is to use corrected range instead of map range as deflection board argument. The question as to whether corrected or map range should be used in computing deflection corrections and time of flight for travel will be taken up in another project.

II—COMPUTATIONS.

5. *a.* (Table A)

TABLE A

PLOTTING BOARD ERRORS.

Speed of Target = 30 Knots
= 1013 Yds. p. Min.
Travel in 30 Sec. = 500 Yards.

16″ Gun—Proj. 2340 (¾ and Full charge).
14″ Gun—Proj. 1660
12″ Gun—Proj. 1070
12″ Mortar—Proj. 700 (Zone III[X —A])

Predicting Interval = 30 Sec.

Caliber	M.V. F.S.	Elevation. Deg.	Time of Flight Differences for Successive Set Forward Points. ΔT. Inclination of Track to Plane of Fire. 0°	30°	45°	60°	Range Errors Due to Use of Wrong Time of Flight. Yds. Inclination of Track to Plane of Fire. 0°	30°	45°	60°	Deflection Error Due to Use of Wrong Time of Flight. Yds. Inclination of Track to Plane of Fire. 0°	30°	45°	60°
16″ R	2190	45	6.8	6.2	5.5	4.4	113	89	65	36	0	51	65	62
	2700	45	4.5	3.9	3.3	2.5	75	56	39	21	0	32	39	35
14″ R	2150	20	1.5	1.3	1.1	0.8	25	19	12	6	0	11	12	12
	2350	20	1.5	1.3	1.1	0.8	25	19	13	6	0	11	13	12
12″ R	2250	35	2.7	2.4	1.9	1.4	45	34	23	12	0	20	23	20
12″M	635	45	5.6	4.9	4.5	3.7	94	71	53	31	0	41	53	53
	1800	45	5.4	5.0	4.3	3.3	89	72	51	27	0	41	51	48
16″ R	2190	20	1.3	1.1	0.9	0.7	22	16	12	6	0	9	11	10
	2700	20	1.0	0.9	0.7	0.5	17	13	8	4	0	7	8	7
14″ R	2150	10	1.1	1.0	0.8	0.6	18	14	9	5	0	8	9	9
	2350	10	1.0	0.9	0.7	0.5	17	13	8	4	0	7	8	7
12″R	2250	10	1.1	1.0	0.8	0.6	20	14	9	5	0	8	9	9
12″M	635	58° 35′	2.1	1.8	1.5	1.1	35	26	18	9	0	15	18	16
	1800	60	0.5	0.4	0.4	0.3	8	6	5	2	0	3	5	4
12″M	635	55	2.6	2.3	1.8	1.3	43	32	21	10	0	19	21	19
	1800	55	1.4	1.2	1.0	0.7	23	17	12	6	0	10	12	10

b. It will be seen from the foregoing that range and deflection errors which should not be neglected result from the practice of computing travel to setforward point with the time of flight for last setforward point.

6. *a.* (Table B)

Table B

RANGE BOARD—PERCENTAGE CORRECTION—YARDS

Caliber	M.V. F.S.	Elevation	Change in Correction Due to Target Travel of 500 yds. Using Percentage of Last Preceding Set Forward Point—Yards.									
			−150 F.S. change in M.V. 0° incl.	M. V. 2/3 Max. Variation (100 F.S.) Inclination of Track				+16% change in Density. 0° Incl.	Atmosphere 2/3 Max. Variation (10.6%) Inclination of Track			
				0°	30°	45°	60°		0°	30°	45°	60°
16″ R	2190	45	52	35	30	25	18	29	19	16	13	10
	2700	45	49	34	29	24	17	33	22	19	16	11
14″ R	2150	20	52	35	30	25	18	28	19	16	13	10
	2350	20	46	31	27	22	16	32	21	18	15	11
12″ R	2250	35	44	29	25	21	15	35	23	20	16	12
12″ M	635	45	203	135	117	95	68	6	4	3	3	2
	1800	45	44	29	25	21	15	32	21	18	15	11
16″ R	2190	20	54	36	31	26	18	28	19	16	13	10
	2700	20	44	29	25	21	15	29	19	16	13	10
14″ R	2150	10	56	37	32	26	19	19	13	12	9	7
	2350	10	51	34	29	24	17	33	22	19	16	11
12″ R	2250	10	54	36	31	26	18	20	13	17	9	7
12″ M	635	58–35	203	135	117	95	68	7	5	4	4	3
	1800	60	44	29	25	21	15	35	23	20	16	12
12″ M		55	203	135	117		68	7	5	4	4	3
		55	44	29	25	21	15	34	23	20	16	12

b. (Table C)

c. (Table D)

d. (Table E)

e. It appears here that as a rule, except in the case of mortar fire, the separate errors with the range correction board due to setting ruler at range of last preceding setforward point are not often significant with correction either in percentage or in yards. In the case of the 12-inch mortar, the errors are negligible at no range when course of target diverges appreciably from normal to plane of fire.

f. A summation of possible errors from large M. V. and atmosphere corrections, (Table E) and a tabulation of values of Δ R indicates that the method of using last preceding time of flight in determining new travel is the source of the largest error, but that the total of errors due to setting of ruler of range board at range of last preceding setforward point may approximate 100 yards in amount. This suggests the desirability when travel in range is great, of providing for setting the ruler of range board at a range more closely approximating the actual range of new setforward point. It will be seen later that it is proposed to accomplish this by the same means that closer value of the time of flight is provided for.

7. *a.* (Table F)

Table C

RANGE BOARD ERROR

30 Sec. Int. Speed 500 Yds. per 30 Sec. (Correction in Yards).

Caliber	M.V. F.S.	Elevation	M.V.: −150 F.S. in MV.—30 Sec. Int. 0° Incl.	M.V.: Error due to use of last preceding Set F. P. Interval 30 Sec. 2/3 Max. Variation (100 F.S.) Inclination of Track 0°	30°	45°	60°	Atmosphere Density: +16% change in At. Den. 30 Sec. Int. 0° Incl.	Atmosphere Density: Error due to use of last preceding Set F.P. Interval 30 Sec. 2/3 Max. Variation (10.6%) Inclination of Track 0°	30°	45°	60°
16″ R	2190	45	21	14	12	10	7	4	3	3	2	2
	2700	45	76	51	44	36	26	5	3	3	2	2
14″ R	2150	20	39	26	23	18	13	44	30	26	21	15
	2350	20	34	23	20	16	12	54	36	31	25	18
12″ R	2250	35	27	18	15	13	9	56	37	32	26	19
12″ M	635	45	201	134	116	95	67	5	3	3	2	2
	1800	45	21	14	13	10	7	16	11	10	8	6
16″ R	2190	20	47	31	27	22	16	42	28	24	20	14
	2700	20	43	29	25	20	15	45	30	26	21	15
14″ R	2150	10	45	30	26	21	15	37	25	22	18	13
	2350	10	42	28	24	20	14	42	28	24	20	14
12″ R	2250	10	43	29	25	20	15	41	27	23	19	14
12″ M	635	58°35′	185	123	106	87	62	2	2	2	1	1
	1800	60	56	38	33	27	19	25	17	15	12	9

Table D

SUM OF ERRORS—PERCENTAGE CORRECTION

Range: For Dif. in Time, M. V. and Atmosphere.
Range—Incl. 0°

Caliber		16″ R		14″ R		12″ R	12″ M		
M. V.		2190	2700	2150	2350	2250	Zone III	Zone X-A	
Elevation		45	45	20	20	35	45	45	
ΔR, M.V. (True)	(a)	21	76	39	31	27	201	21	
ΔR, M.V. (R. Bd. in %)	(b)	52	49	52	46	41	203	44	
ΔR, Atmos.	(c)	4	5	41	54	56	5	16	M.V. = −150 f.s.
ΔR, Atmos. %	(d)	29	33	28	32	35	6	32	
Errors.									AT = ×16%.
ΔR. Plot. Bd.		113	75	25	25	45	94	89	
ΔR, M.V. (b-a)		31	27	13	12	17	2	23	
ΔR. Atmos. (d-c)		25	28	16	22	21	1	16	
Sum—Yds.		169	130	54	59	83	103	128	
Sum—% of R		0.52	0.27	0.27	0.26	0.31	2.63	0.72	
Elevation		20	20	10	10	10	55	55	
ΔR, M.V. (True	(a)	47	43	45	42	43	198	49	
ΔR, M.V. (R. Bd. %)	(b)	54	44	56	51	54	203	44	
ΔR, Atmos. (True)	(c)	42	45	37	42	41	2	25	
ΔR. Atmos. (R. Bd. %)	(d)	28	29	19	33	20	7	34	
Errors, using R. Bd. in %									
ΔR, Plot. Bd.		22	17	18	17	20	43	23	
ΔR. M.V. (b-a)		7	1	11	9	11	5	5	
ΔR, ATM. (d-c).		14	16	18	9	21	5	9	
Sum—Yds.		43	34	37	36	52	53	37	
Sum—% of R.		0.19	0.10	0.29	0.25	0.39	1.46	0.22	

Table E

SUM OF ERRORS—YDS.—FLAT CORRECTION

Range: For Dif. in Time, M.V. and At. Den.—Yds. and %.
Deflection: For Dif. in Time, Wind, Drift—Degrees.

Range—0° Inclination.

Caliber	16" R		14" R		12" R	12" M		
M.V.	2190	2700	2150	2350	2250	Zone III	X-A	
Elevation	45	45	20	20	35	45	45	
△R, Plotting Board	113	75	25	25	45	94	89	
△R, M. V.	21	76	39	34	27	201	21	Note: Change in
△R, Atmosphere	4	5	44	54	56	5	16	M.V. = −150 f.s.
Sum, Yds.	138	156	108	113	128	300	126	Atmosphere Den-
Sum, %, of—R.	0.42	0.32	0.43	0.50	0.44	7.68	0.70	sity = +116%.
Elevation	20	20	10	10	10	55	55	
△R, Plotting Board	22	17	18	17	20	43	23	
△R, M.V.	47	43	45	42	43	198	49	
△R, Atmosphere	42	45	37	42	41	1	24	
Sum, Yds.	111	105	100	101	104	242	96	
Sum, % of R.	0.49	0.32	0.79	0.69	0.79	6.70	0.58	

DEFLECTION—45° INCLINATION.

Elevation	45	45	20	20	35	45	45	
△D, Plotting Bd.	0.12	0.05	0.03	0.03	0.06	0.77	0.16	
△D, Wind	0.01	0.01	0.02	0.01	0.02	0.28	0.12	Note: 50
△D, Drift	0.18	0.11	0.03	0.03	0.05	1.35	0.74	M.P.H. Wind.
Sum—Degrees	0.34	0.17	0.08	0.07	0.13	2.40	1.02	
Elevation	20	20	10	10	10	55	55	
△D, Plotting Bd.	0.03	0.01	0.04	0.03	0.04	0.34	0.05	
△D, Wind	0.01	0.01	0.01	0.01	0.02	0.26	0.10	
△D, Drift	0.01	0.01	0.02	0.01	0.01	1.29	0.22	
Sum—Degrees.	0.05	0.03	0.07	0.05	0.07	1.83	0.37	

b. From the foregoing it appears that errors in drift computation using range of last preceding setforward point may be significant while wind effects will have appreciable errors in the case of the 12-inch mortar only.

8. Similar computations in the case of the 16-inch howitzer will, in the case of elevations above 45 degrees, give results similar to those for mortars.

III—Discussion.

9. From an examination of the tables in Section II, it appears that the ordinary fire control methods applicable to targets moving at low speeds require modification to secure the desired accuracy in the case of high speed targets. These requirements are:

a. That a time of flight corresponding as closely as possible to the range of the new setforward point be used in computing travel to that setforward point.

b. That range board ruler be set at or near range of the setforward point for which range corrections are to be computed.

c. That range used as argument with deflection board be range of actual (latest) setforward point.

d. That sight deflection for travel of target in azimuth, whether measured by gun pointer or computed on deflection board, be based on time of flight corresponding to range of actual (latest) setforward point.

TABLE F

DEFLECTION BOARD ERROR—DEGREES.

30 Sec. Int. Speed: 500 Yds. per 30 Sec.

Caliber	M.V. F.S.	Eleva-tion	Drift: Error due to use of Last Preceding Set F. P. Interval, 30 Sec. Inclination of Track				50 M.P.H. Wind: Error due to use of Last Set F. P. Interval, 30 Sec. Inclination of Track			
			0°	30°	45°	60°	0°	30°	45°	60°
16″ R	2190	45	0.21	0.20	0.18	0.13	0.05	0.04	0.04	0.03
	2700	45	0.15	0.14	0.11	0.08	0.01	0.01	0.01	0.01
14″ R	2150	20	0.03	0.03	0.03	0.02	0.03	0.03	0.02	0.02
	2350	20	0.05	0.04	0.03	0.02	0.02	0.02	0.01	0.01
12″ R	2250	35	0.06	0.06	0.05	0.03	0.03	0.03	0.02	0.02
12″ M	635	45	1.80	1.59	1.35	1.02	0.40	0.35	0.28	0.20
	1800	45	1.01	0.90	0.74	0.58	0.17	0.15	0.12	0.09
16″ R	2190	20	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
	2700	20	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
14″ R	2150	10	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01
	2350	10	0.02	0.02	0.01	0.01	0.02	0.02	0.01	0.01
12″ R	2250	10	0.01	0.01	0.01	0.01	0.03	0.03	0.02	0.02
12″ M	635	58° 35′	2.14	1.85	1.52	1.07	0.27	0.24	0.19	0.14
	1800	60	0.34	0.30	0.24	0.17	0.12	0.11	0.09	0.06
12″ M	635	55	1.91	1.50	1.29	.84	0.28	0.24	0.20	0.14
	1800	55	0.44	.39	.22	.21	0.15	0.13	0.10	0.08

(1) This together with comprehension of the amount of the deflection correction for travel indicates that the travel correction should be computed in the plotting room and not measured by the gun pointer.

(2) The question as to whether map range or corrected range should be used as deflection board argument need not be considered here.

10. The method of meeting the foregoing requirements described below is proposed as the result of a study almost entirely theoretical. Practical solution of this problem can result only from test of service. It follows that practice in firing a high speed target is highly desirable. Since an actual high speed target cannot be had for practice, it appears advisable:

a. To fire at purely hypothetical target.

b. To use sub-caliber target with reduced scale to simulate high speed target (if practicable).

c. To have fire control drill with commercial or naval vessels moving at high speed whenever practicable.

d. To use high speed targets with minature ranges.

11. The following method of solving the problem is proposed for test:

a. Figure 1 represents a sheet of cross section paper for use as range time board with special variations as indicated. It will be noted that in addition to the vertical time lines numbered 1, 2, 3, 4, etc., there are curves numbered III, IV, etc. (Curves I and II are omitted for clearness). These curves may be graduated in times of flight. The curve III is constructed by measuring from time line 3 to the right a distance for any range (as indicated on vertical scale)

measured by the time of flight for that range. From this it follows that times on curve III represent for any range the time of splash of a projectile fired at time 3.

b. If a range time relation curve be plotted on observations at time 1 and 2 and prolonged to curve III, the intersection will give an approximate value of the range to the setforward point for prediction 30 seconds ahead of time 2.

c. After prediction starts, since ranges to setforward points only are read by plotter, time range relation is plotted from setforward points each on its proper time curve as read, and predictions made as desired.

d. This form of prediction can be used to obtain:

(1) Time of flight based on preliminary prediction of actual range of setforward point.

(2) Approximate range for setting of range board ruler.

(3) Approximate range from which preliminary computation of corrected range may be made for the purpose of using corrected range (if this be prescribed) in computing azimuth or deflection corrections and time of flight.

e. The time range device shown is complete in itself and is separate from the travel correcting device shown in the right hand part of the board and to be described later.

f. In case of a howitzer, gun, or mortar using a number of zones this board will be complicated by the necessity of having curves for different zones drawn in in colors.

g. This small drawing indicates only the method of solution of the problem. It may be seen that it will probably be necessary to construct a chart which can be mounted on rulers and turned under a celluloid or xylonite plate upon which the time range relation curve may be drawn.

h. In general, the operation of this time range relation device provides simply for a preliminary prediction of the approximate range for one setforward point ahead of the one for which the actual range has been read by the plotter.

i. The right hand portion of the diagram is a simple travel computing device and is inserted for the purpose of indicating that the man who performs the duty of travel computer in the plotting room can operate the time range relation device as well. This travel computing device is so constructed that the reading on the ruler at its intersection with the curve numbered to correspond to the travel in 30 seconds called by the plotter will give the travel in 30 seconds plus the time of flight.

(1) In case of guns or mortars using several charges the right hand chart would be constructed for times of flight rather than ranges.

(2) If corrected ranges are to be used in computing travel then the ruler for this chart would be read at the preliminary corrected range instead of the map range of the setforward point.

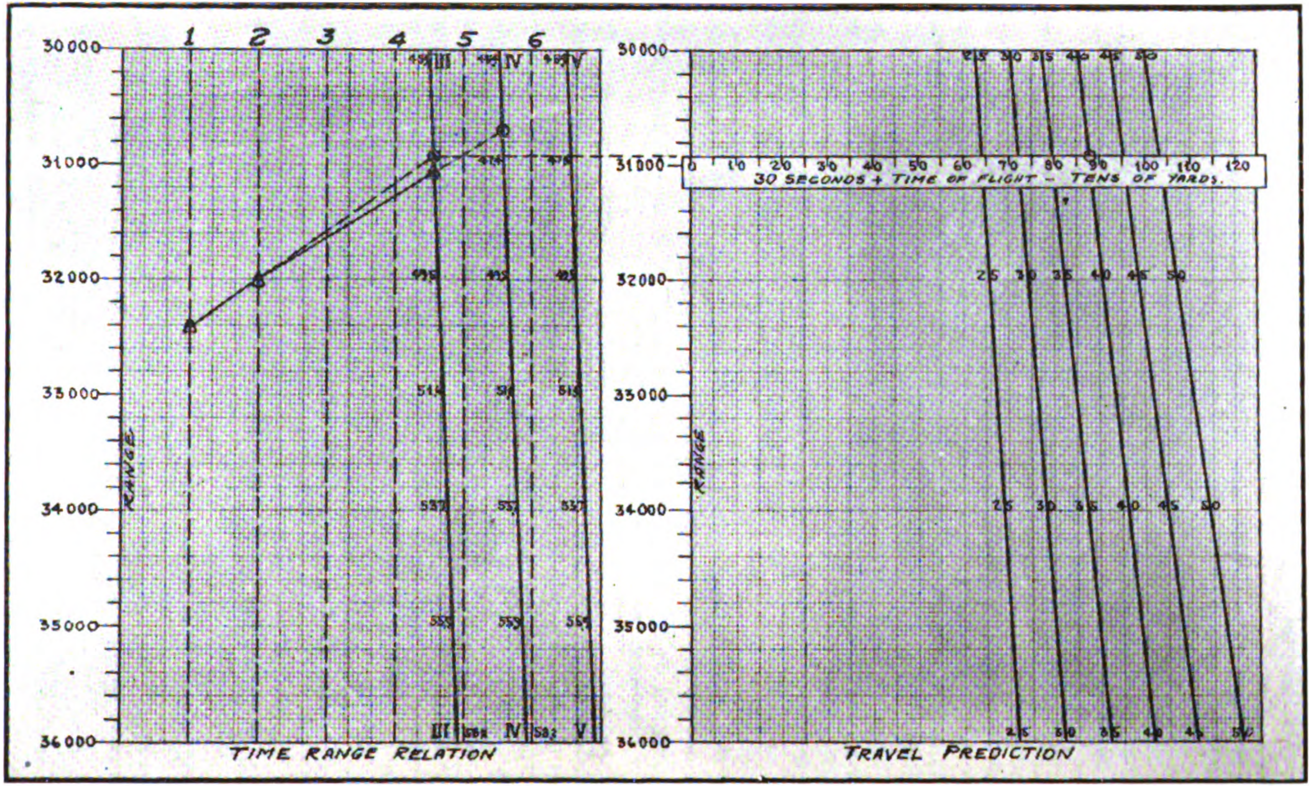
j. It is to be noted:

(1) That the range prediction on this board is intended to be preliminary and in no sense to replace the determination of the map range of the setforward point by the plotter.

(2) That the device is presented in its simplest form and is intended only to indicate a possible means of eliminating the errors pointed out above.

(3) That the Coast Artillery Board is prepared to work up this board in operable form should it be desired to make use of the device for service test at a particular battery.

(4) That this solution as offered is one and not the only possible solution.



Section of Time Range and Prediction Board
16-inch Gun—Full Charge
Proj: 2340 lbs. *M. V. 2700 F. S.*

12. The proposed predicting device suggests a possible solution of some of the problems in connection with fire at high speed targets. It requires an additional man to operate it only in those plotting rooms where a separate range computer has been dispensed with.

13. Service test of this and other methods for improving the accuracy of fire control methods in the case of high speed targets is desired.

IV—RECOMMENDATIONS.

14. It is recommended:

a. That steps be taken to bring to the attention of the Coast Artillery service the special conditions for fire at high speed targets.

b. That fire control methods not applicable to high speed targets be not permitted for regular drill or practice with any moving target.

c. That arrangements be made for at least one practice per year in each active coast defense command at high speed hypothetical target.

d. That in case it is desired to assign particular batteries to the development of methods of fire control the Coast Artillery Board be instructed to communicate directly with those batteries and to furnish to them devices similar to those described in paragraph 10.

ACTION BY CHIEF OF COAST ARTILLERY.

The following is the action taken by the Chief of Coast Artillery on this project:

First Indorsement

War Department, O. C. C. A., April 7, 1925—To the President, Coast Artillery Board, (through Commanding General 3d Coast Artillery District) Ft. Monroe, Va.

1. This project has been given careful consideration and while this office concurs in the views of the Coast Artillery Board as to the desirability of developing fire control methods suitable for accurate plotting of high speed targets, it is deemed advisable at present to take the following action on the recommendations contained in Section IV:—

a. There is no objection to the publication of this project in the COAST ARTILLERY JOURNAL so long as the action indicated in this indorsement is also published.

b. Until such time as a better system may be developed and tested, the present fire control methods will be used.

c. It is not considered practicable at this time to require each Coast Defense Command to conduct firings at high speed hypothetical targets.

d. If, at a later date, it becomes practicable to assign a particular battery to test the devices described in this project, the Coast Artillery Board will be so informed and authorized to assist in the test.

BOOK REVIEWS

The Campaign in Mesopotamia (Volumes I and II). Compiled under the direction of the Historical Section of the Committee of Imperial Defense by Brigadier General F. J. Moberly, C. B., C. S. I., D. S. O., p. s. c., His Majesty's Stationery Office, London, 1924. Per volume $3.00.

These two volumes cover the operations in Mesopotamia to include the surrender of General Townshend at Kut-el-Amarah, April 29, 1916. The maps and sketches are clear and complete. Included in Volume II is a short story of the experience of the British and Indian in captivity, and acknowledgment of the services on their behalf of United States Ambassadors Morgnthau and Elkins, and Netherlands Minister de Willebois.

Because of the necessity of explaining fully everything that occurred in connection with each operation in Mespotamia and particularly with General Townshend's ill fated advance on Baghdad, copious extracts of the correspondence between the Imperial Cabinet and War Office, the Indian Government, and the Commanders in Mesopotamia are included. It is laborious reading, but the reader will be amply repaid.

Primarily the operations in Mesopotamia had three main objects; the protection of British interests in the Persian Gulf, the protection of the oil works at Abadan with the pipe line to the Anglo-Persian oil fields, and the support of friendly Arabs, particularly the tribes of the Shaikhs of Mohamerah, Nonh, and of Kurvait west of the Persian Gulf.

How the Commanders of the British force were led to extend their operations along the Tigris and to attempt with insufficient force and entirely inadequate transport, the capture of Baghdad is related in full detail. It appears that the Imperial Cabinet, The Indian Government, and the Commander in Chief in Mesopotamia all really favored the advance on Baghdad, but none wished to assume responsibility. Marshal Kitchener and General Townshend, who was destined to command the expedition, seem wholeheartedly to have opposed it.

There is no lack of detail of the military operations, and a full statement of the reasons why General Townshend permitted himself to be invested at Kut. The reviewer finds these reasons inadequate, but it is only fair to point out that Townshend had in Kut two months supplies which he would have been unable to take with him on a retreat beyond that point, and that should the Turks have been able to pin him down further southward and then surround him, he could not have held out so long.

Up to the investment of Kut the British operations had been strategically unsound because of their disregard of the consequences of a tactical defeat or even of a failure of complete success. While bold to recklessness, tactically these operations seem to have been well adapted to the object.

But the operations for the relief of Kut illustrate almost every conceivable tactical blunder. Time after time all chance of tactical success is lost by premature withdrawal from action. Coordination of offensive action is nearly always lacking.

It will be news to many readers that in the attacks on the Dujoila redoubt March 8, 1916 (50 days before the surrender) two British divisions were within eight miles of Townshend's position at Kut, and that the Turks who were in inferior numbers here were on the verge of withdrawing. Here as elsewhere, the partial attacks were not coordinated but were made successively so as to derive no advantage from each other. It is difficult to conceive the possibility of so much confusion as existed in the British command here. And it can be said that here is one of the most glaring examples in military history of failure because of the retention by the supreme commander of the control of minor operations. The reviewer believes a detailed study of this action will repay any military student.

The two volumes invite the reader to draw conclusions. For example, one feels that the British Commanders failed completely to take account of the defensive qualities of the Turks by which the latter were enabled to besiege Kut, and repulse all attempts at relief. This and the fact that the Turks were nowhere successful offensively should have been decisive arguments against Townshend's stop at Kut. And it seems particularly unfortunate that the British Commander-in-Chief in Mesopotamia, in the earlier operations (Nixon) should have been somewhat over aggressive when caution appears to have been advisable, while his successor (Lake) was inclined to caution when boldness was essential to the relief of Kut.

It is expected that the subsequent volumes of this history will be no less interesting and illuminating than these two.—R. S. A.

The Constitution of the United States. By James M. Beck, LL. D. George H. Doran Co., New York, 1924. 6"x 9". 362 pp. $2.50.

President Coolidge says in the Foreword "It is of first importance that the study of the Constitution should be an essential part of the education of the American youth. * * * The Constitution is not self-perpetuating. If it is to survive, it will be because it has public support. * * * To live under the American Constitution is the greatest political privilege that was ever accorded to the human race."

The author, who, in addition to having served as Solicitor-General of the United States, is an officer of the Legion of Honor, and Honorary Bencher, Gray's Inn, London, has undoubtedly spent much time in the preparation of this work. It shows the results of extensive study and painstaking research. This book had its origin in five lectures which the author delivered in the Hall of Gray's Inn, London, during 1922 and 1923. The lectures were subsequently published as such in New York, London, and Paris. Since there seemed to be a continuing demand, the author decided to rewrite the book entirely by eliminating the lecture form and adding considerable material. This trebled the contents of the book. This is the new work and in it he has endeavored to include all available material relating to the making of the Constitution.

The history of the making of the Constitution is most interesting and instructive. The following extracts, taken chronologically from the book, will give an idea of the manner in which the subject is treated:

"The Constitution has its roots in the great and heroic past of the English speaking race."

"The spirit of the framers of the Constitution was less emotional and more practical than that which inspired the Declaration of Independence."

In discussing the chaotic state of the country during the last days of the Confederation the views of several eminent men of the times are given. Washington wrote to George Mason at the time:

"I have seen without despondency, even for a moment, the hours which America has styled its gloomy ones, but I have beheld no day since the commencement of hostilities that I thought our liberties in such imminent danger as at present. Indeed, we are verging so fast to destruction that I am feeling that sense to which I have been a stranger until within these three months."

In speaking of the great convention, the author remarks:

"Now follows a notable and yet little known scene in the drama of history. It reveals a people who, without shedding a drop of blood, calmly and deliberately abolished one government, substituted another, and erected it upon foundations which have hitherto proved enduring. Even the superstructure slowly erected upon these foundations has suffered little change in the most changing period of the world's history. There have been but few additions and, except for the Amendments immediately following the Civil War, only the most recent additions have made notable changes from the plans of the original architects. The Constitution is today, not a ruined Parthenon, but rather as one of those Gothic masterpieces, against which the storms of passonate strife have beaten in vain. The foundations were laid at a time when disorder was rampant and anarchy widely prevalent."

Several delegates to the convention were late. Washington, on time as usual, remarked "These delays greatly impede public measures, and serve to sour the temper of the punctual members, who do not like to idle away their time."

Realizing that this was true, Franklin "invited all the delegates who had reached Philadelphia on May 16, 1787, to dine with him * * * knowing that a good dinner was often the solvent of many difficulties." One chapter of the book is devoted to a most interesting description of the dinner and the guests who attended.

The discussion of the preliminaries to the convention takes up another chapter of the book and in concluding his remarks the author states that "To George Washington, soldier and statesman, is due above all men the ideal of a federated union, for without his influence—that of a trusted and unselfish leader—the great result would probably never have been secured. While still waiting for the convention to meet, and while discussing what was expedient and practicable when they did meet, Washington one day said to a group of delegates, who were considering the acute nature of the crisis:

> "It is too probable that no plan that we propose will be adopted. Perhaps another dreadful conflict is to be sustained. If, to please the people, we offer what we ourselves disapprove, how can we afterwards defend our work? Let us raise a standard to which the wise and just can repair. The event is in the hand of God."

Notable words, worthy of acceptance in all times and in all nations, and it was in this spirit that the convention finally convened on May 25, 1787."

Under the headings of "The Opening of the Convention," "Opening of the Battle," "Mr. Hamilton Takes the Floor," "Nearing the Crisis," "The Crisis," "The Dawn," "The Convention Witnesses a Great Experiment," "Nearing the End," and "The Curtain Falls" the author takes the reader through the Convention as far as available records will permit. The relation is apparently com-

plete. The most astonishing thing in the narrative is the fact that, despite the gentlemanly arguments and intense discussions of the convention, there was no word spoken outside of the convention regarding their work and no one other than the delegates themselves had any idea of what they were doing during the four months they were in session. When the convention adjourned to permit the delegates to witness John Fitch's experiment "Little the Framers of the Constitution could appreciate on that 22nd of August, 1787, that an epoch that had lasted for many centuries, the pastorial-agricultural age of mankind, was then forever passing and that a new epoch of mechanical power, amplified a thousand-fold more than their utmost imagining, was about to begin." The signing by the delegates was not done without hesitancy on the part of some. "Many delegates had left in disgust and the fifty-five had shrunk to forty-two. Of the latter three refused to the last to sign."

"The Ratification of the Constitution" gives an account of the difficulties encountered in the various states. Finally, in May, 1790, Rhode Island accepted it. "Thus again was completed the union of the thirteen States, this time in fact, as in name, "a more perfect union." Upon what a slender thread had hung the destinies of the United States! The vote of eighteen men would have certainly defeated the ratification of the Constitution. If ten Massachusetts delegates, six delegates of Virginia and two of New York had changed their votes, the noble work of the Philadelphia Convention would have come to naught. The United States would not, at least at that time, have come into existence, and its present Constitution, the admiration of the world, would have become waste paper, if, by a change of only eighteen votes the great States of Massachusetts, Virginia and New York had absented themselves from the "more perfect union."

Chapter XVI covers "The Political Philosophy of the Constitution."

"The Basic Principles of the Constitution" listed below are then taken up and each of them is discussed. The author lists them as:

> The first is representative government.
>
> The second and most novel principle of the Constitution is its dual form of government.
>
> The third principle was the guaranty of individual liberty through constitutional limitations.
>
> Closely allied to this doctrine of limited governmental powers, even by a majority, is the fourth principle of an independent judiciary.
>
> Possibly no provision of the Constitution is of greater interest to the publicists of other nations than this unique tribunal (The Supreme Court).
>
> The sixth basic principle of the Constitution seeks to prevent the concentration of power in any one man or body of men by a complex system of checks and balances.
>
> The joint power of the President and Senate in the determination of the foreign policies of the United States.

One chapter is devoted to "The Constitution and America's Foreign Relations," while another "A Century Later" pictures the Centennial Anniversary of the Constitution held in Philadelphia in 1887.

Under the heading "A Rising or a Setting Sun" the author pictures the tendency of modern times. "Unless the American people awaken to the necessity of defending their most priceless heritage, there is manifest danger that within the lives of those now living the form will survive the substance of the faith."

In "The Decay of Leadership" the author agrees with Cicero "Such as are the leading men of the State, such is the State itself" and with Lord Bryce when he said "The proportion of men of intellect and social eminence who enter public life is much smaller in America than in each of the free countries of Europe."

"Of all the phenomena which have resulted from the age of the machine, the most striking is the revolt against authority, and by authority is meant not only the laws of the State, which are the least important, but the great laws of social life and the conventions and traditions of the past."

"Work for work's sake, as the privilege of human faculties, has largely gone, both as an ideal and as a potent spirit, with millions of men."

"When that parchment was last taken from the safe in the State Department, the ink, in which it had been engrossed nearly one hundred and thirty-seven years ago, was found to have faded.

"All who believe in constitutional government must hope that this is not a portentious symbol. The American people must write the compact, not with ink upon parchment, but with "letters of living light"—to use Webster's phrase—upon their hearts."

Again the solemn warning of the wise men of old suggests itself:

"Where there is no vision, the people perish; but he that keepeth the law, happy is he."

The six appendices give: The Virginia Plan; The New Jersey Plan; The Constitution of the United States; Macauley's Correspondence with Randall; Washington's Appeal; Miscellaneous Notes.

Well written and extremely interesting, this book would be a most valuable addition to every American's library.—H. B. H.

The Profession of Arms. By Elbridge Colby. D. Appleton and Company, N. Y. 5"x 7". 183 pp. $1.50.

The author, Sometime Proudfit Fellow in Letters, Columbia University and now a Captain of Infantry, is well known to the Army as a contributor to various service publications.

The purpose of the book as stated in the preface "is simply to represent the Army, its motives, its work, its sacrifices and satisfactions, to the young men of the country."

This book is of interest to all members of one of the oldest of professions—the Profession of Arms—and is of value to all who would know more about a profession to which every citizen of this country may be called at any time; and is invaluable to those who may consider entering the profession permanently.

If this little book dispels some of the misconceptions about the Army, the author will have rendered a distinct service to his country for an understanding by the citizenry of the Army is of importance to our National Defense.—R. V. C.

William Crawford Gorgas. By Marie D. Gorgas and Burton J. Hendricks. Doubleday Page and Co., Garden City, N. Y. 6½"x 9". 359 pp. $5.00.

This work, while an extremely entertaining and interesting book, loses some of its value to the history student, due to the fact that the authors' view point is a little too close. In some instances they err on the side of caution in not giving full credit to General Gorgas especially in certain controversies which he had with his superiors during the building of the canal. However, the book is good reading from start to finish, and due to the same close point of view, we learn many things of General Gorgas' life and character, which no other biographer could give us.

One fact of especial interest, is that it was his desire to enter the regular army, which determined General Gorgas to study medicine. Failing in his efforts

to obtain an appointment to West Point, medicine seemed to be the door by which he could enter. And so we see the young southerner, starting out as a medical student always with the idea in mind that some day it might win him a commission in the Army.

General Gorgas' life seems to have been crossed by the yellow fever path from the very beginning. It was during a yellow fever scare that his mother and father met, and it was while they were both ill with the fever, that General Gorgas, then a junior medical officer, met the future Mrs. Gorgas. Then came his detail to work with Walter Reed in Cuba to try and stop the frightful tool of deaths from the plague. All credit for the discovery of the means of contagion are given to Reed, but it was Gorgas who evolved the system of eradicating the mosquitos, and teaching the Cubans what a menace a small can of water could be to an entire community.

This part of the book is extremely well done, as are also the chapters on the sanitation of the Panama Canal. If General Gorgas had only done these two things in his life, civilization would still owe him an incalculable debt. But even after his health was failing, he kept on, declining to delegate his work to others, until death came to him as he was on his way to find the last stronghold of his enemy.

Other biographies of General Gorgas will be written, but this one will be unique in showing the lovable character of the man himself and his utter devotion to his duty and his country.—L. B.

The Fruit of the Family Tree. By Albert Edward Wiggam. The Bobbs-Merrill Company, Indianapolis, 1924. Illustrated. 6"x 9". $3.00.

The author is a popular lecturer and writer on scientific subjects. He has attempted, and with success, to dramatize for the average reader the present day knowledge on heredity and its relationship to human progress.

The writer shows that not only races vary in character and intelligence but human breeds vary. That there are strains of blood that by wise marriages have produced a large per cent of the leaders of the world.

There is much valuable information in this book which will be taught some day in schools and colleges more generally than is done at present.

Some of the subjects discussed are: Does Blood Tell? Is Brain-Power Inherited? Does Heredity or Environment Make Men? What Twins Tell About Heredity. What Cousin Marriages Tell About Heredity. The Truth About Prenatal Influences. Measuring Heredity in Royalty. Birth Control. Does Science Know the Mechanical Means of Heredity by which Virtue and Vice, Intelligence and Stupidity are Transmitted from Parent to Child.

Here is a book not only worth reading but worthy of a place in the home library.—W. W. I.

Talking Well. A Book on the Art of Conversation, by W. L. Harrington and M. G. Fulton. The MacMillan Company, New York. 5"x 7¾". 196 pp. $1.40.

This small book is filled with valuable suggestions and lessons for those who wish to develop or improve their conversational English. It should prove to be of considerable help also to those who aspire to public speaking or whose duties require frequent, or even occasional, addresses in public.

The principal subjects covered are Essentials of Good Conversation, Story Telling, Advice on Voice Improvement, Sales Talks, Reading or Recitation, Platform Manners and Delivery, and Colloquial English.—R. D.

Atoms and Electrons. By J. W. N. Sullivan. George H. Doran Company, New York, 1924. $4\frac{1}{2}$"x 7". 188 pp. $1.25.

This is a clear, interesting and concise statement of the great advance that has been made in recent years toward discovery of the fundamental laws of the constitution of matter and energy. It is a book excellently adapted to its avowed purpose. It brings to the Modern Readers' Bookshelf ("for the humanizing of knowledge") such an authoritative presentation of the main gist of modern science as should strongly appeal to the intelligent reader.

Treating of a highly technical subject and appealing to a popular audience is always a matter for compromise. In the present instance the author has rightly counted on sufficient eagerness after knowledge on the part of his readers to carry them through a period of concentration and studious thought to the glorious revelation that the human mind is able to weigh to the trillion-trillionth of an ounce, measure the space within an atom, and arrange the varied phenomena of X-ray and ultra-violet spectra in logical order. Let no one with sluggish immagination expect to find delight in following the intricacies of such tremendously minute beings as electrons are shown to be, or in keeping pace with such prodigious velocities as they are said to possess.

After an introductory chapter on units and notation, the book reviews hastily the atomic and molecular theories which have underlain the science of chemistry for some years. Thence we are led on to the belief that atoms are not after all indivisible, but are built up, all from the same material—and that that material is electricity. Succeeding chapters are occupied in showing in greater detail just how the complicated structure of atoms is composed, citing a variety of experiments in substantiation of the hypotheses advanced, and drawing conclusions explainable in the light of such beliefs.

That these conclusions are by no means dogmatic,—a goal arrived at,—but that vast new fields are just beginning to open out to a vista of intellectual progress, is the most inspiring spirit of this little book.—P. H. F.

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A 16-inch Howitzer—one of the Nation's Guardians at the Entrance of Chesapeake Bay

THE COAST ARTILLERY JOURNAL

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Combat Methods of the Japanese*

By Colonel C. E. Kilbourne, C. A. C.

TO THOSE who would appreciate the basic causes of the success or the failure of a campaign no royal road can be pointed out. The study of a nation's doctrines of war, of her field service and drill regulations is valuable but not conclusive. If accepted at face value these may lead to erroneous conclusions, that, in turn might lead to erroneous action on the battlefield. Two nations may announce the offensive, the objective and cooperation as being the principles most important to insure success of an engagement, but their interpretation of these terms may be quite different. Again, two nations may state that the Infantry is the primary arm, one expecting to attack with the bayonet under cover of such artillery support as may be obtainable, the other expecting to shatter the enemy with artillery fire, using the Infantry to mop up and occupy the position so gained.

The relation between distinctive combat methods and announced doctrines can be learned only by a detailed study of campaigns in which the student is willing to examine all orders and decisions and to trace the effect of these down to the smallest unit. This will frequently indicate the persistence of certain methods and principles in spite of character of terrain, of development in mechanical means of warfare and of enemy reaction. It is on such a detailed study that the following notes on the Japanese army are based. Doubtless selected instances may appear to contradict conclusions drawn, but it is believed the impressions conveyed are, on the whole, reliable.

As to organization we know the larger features but are in doubt as to details. The Japanese endeavor to keep their organization secret and questions are met with polite evasion. The following, therefore, is not to be taken as absolutely accurate.

The Japanese discard the army corps, building the field army direct from divisions. As with us, the G. H. Q. directs the armies, and, in the Russo-Japanese War, continued this direction success-

* This article first appeared in the May issue of the *Infantry Journal*. It is here republished by permission of the author and the U. S. Infantry Association.

fully with a number of armies our present doctrine would lead us to believe so great as to demand the formation of army groups. Their average of three divisions to an army gives the field army approximately the numerical strength of our typical army corps, but it is, in conception, and by the permanent assignment of army troops, essentially an echelon for independent operations.

The Japanese division differs from that of any other great power. Retaining the square formation—two brigades each of two regiments—for the Infantry, their artillery consists of a single regiment of three battalions. In rifle (bayonet) power it is the strongest of all; in artillery and automatic fire the weakest. A regiment of cavalry, of about the strength of our squadron, is assigned. There is no organic air service. The division is complete as to engineers, communication troops and trains. Numerically it is something less than 85 per cent of our war strength division.

During the Russo-Japanese War independent Infantry brigades, some of Infantry only, others "reinforced," were used as army troops and G. H. Q. reserves. They were assigned to armies and withdrawn in accordance with the mission and situation, just as we assign and withdraw G. H. Q. artillery. They were used to enable army commanders to hold out a cohesive reserve and without necessity for disrupting any division. They could replace a brigade that had been exceptionally heavily engaged thus enabling the division to continue its effort. They were used on missions not demanding a complete division, and could make progress (living mainly on the country) in terrain where supply difficulties would tend to immobilize a complete division. For flank protection, for lines of communication, and for many duties requiring the detachment of small forces they saved calls on the divisions, leaving these, and the armies of which they were component parts undisturbed as to normal organization and combat capacity.

They were not "provisional" brigades, but were duly organized from the beginning with permanent commanders and staffs. They had a distinct organizational *esprit;* many will live in history.

Apparently these units have disappeared. They were known as "kobi" brigades, being organized from kobi (first reserve) troops and at present we hear only of "kobi" divisions. The writer believes that independent Infantry brigades will reappear as G. H. Q. reserves in another war. They proved their value too conclusively to have been discarded. Sustaining this belief is the fact that, in Japanese maneuvers, are found independent Infantry units (regiments) in reserve; also it has been noted, in conversation with Japanese officers, that there is a distinct reaction when the operations of the kobi brigades is discussed.

A consideration of the foregoing indicates that the Japanese are not imitators of the organization of any European nation, just as a study of their operations will show that they are far from following blindly the doctrines and methods of any nation in campaign and combat. There seems no doubt that they have studied all and given all due weight, but that organization, strategy and tactics are distinctly their own.

Comment is made from time to time that the Japanese are conservative and slow to change. Their history is contradictory in this. Certainly no nation stood still for so long a period as did Japan under the Shogunate of the Tokugawas. On the other hand they changed from a feudal to a modern state in a generation, their military system keeping pace. They have been criticized for "failing to profit by the lessons of the World War," the relatively small artillery strength, the small percentage of automatic weapons and the practical absence of motor transport being cited. But their attention to air development and the submarine, considered in connection with their past record for careful planning, leads to the logical conclusion that they have not only studied the World War but have applied the lessons to be learned therefrom to their own problems and with the characteristics of the area they wish to control prominently in mind. We should remember that Grant sent the bulk of his army artillery to the base in the campaign of 1864. He could not bring it into action nor supply it. It is probable that Japan has designed her organization for a special theatre, and to bring into action the maximum force, all things considered, in that theatre. Tables of organization do not win battles.

As to leadership the number of armies controlled successfully from a single headquarters direct has already been commented on. The success of this control appears to have been due to the thorough understanding by all commanders of the objective, to complete instruction of each in the mission of the others, to the maximum of personal consultation of commanders during the engagements, and to the use of cavalry for liaison purposes. Among army commanders there was absolute loyalty to the objective, combined with initiative. There are instances where commanders, anticipating the desires of the supreme command, prepared the orders for the next movement of their own troops, and, when the directive was received from General Headquarters, were able to issue the orders so prepared with little or no alteration.

Cooperation among commanders was a matter of course. We find army commanders, without orders or request, voluntarily detaching a brigade to assist another army, possibly thirty miles away. We find regimental commanders (themselves engaged) send-

ing a battalion to the aid of another unit they believed more heavily pressed. Again and again, when information was received that a certain organization had been repulsed or was being counter-attacked, we find contiguous units attacking on their own initiative, or reserves deflected from a local mission to some operation that would tend to relieve the pressure on the threatened unit.

Confidence in commanders seemed to be ingrained, due probably to thorough training and to the loyalty referred to. We are taught that, in a field order, no alternative is admissible; in the Japanese orders such directives as "will *endeavor* to capture," "will occupy ——, if *possible*," were habitually to be found. It was assumed that commanders would do their utmost. As a corollary we find commanders perfectly frank in expressing doubts of success. Again and again division and brigade commanders reported that they could not carry objectives assigned, and, occasionally, that they doubted their ability to resist counter-attack. And this without apparent fear of reproach or punishment. Higher commanders responded to such reports by sending reserves if any were available, or by directing that ground gained should be held to the last man, or that the attack must be continued at all hazards. The writer has found record of only one general officer being relieved from command; there was no Limoge or Blois.

Just as there appears to have been no fear of punishment in event of failure, there seemed no thought of self-advancement and no jealousy. In the Russo-Japanese War there were no indications of indecision, and none of hasty, ill-thought-out action. Calm and deliberate planning, combined with energetic execution seems to have been the rule. And an enormous capacity for personal exertion, continued with practically no intervals for sleep, was notable for division and brigade commanders.

Much has been written of the Japanese soldier, of his courage and endurance. Certainly the assaults at Port Arthur equal any in history for daring and determination. The operations of the 12th Brigade, 12th Division at the Sha-ho set a standard of endurance. This unit fought all day October 11; assaulted and captured Sanchengtzu hills the night of the 11th-12th, carried the ridge to the north on the 12th, crossing a valley 600 yards broad in three rushes; were reorganized for another attack when recalled for a new mission; marched ten miles through a heavy rain storm the night of the 12th-13th; attacked a Russian force on the hills guarding a pass the following morning making several unsuccessful assaults;

reformed to resist attack on the approach of reinforcements to the Russians; took up the pursuit when the enemy began retiring on the 14th; then marched 18 miles over mountain trails to rejoin the division on the 15th.

While the Japanese were pioneers in application of modern methods of massed artillery fire, concealment and indirect fire, there were instances to show that the same aggressive spirit shown by the Infantry actuated also officers and men of the artillery. Their artillery was outranged, but they pushed it forward and generally succeeded in besting the superior artillery of their opponents. The initiative of a junior officer in bringing his mountain guns into an advanced position enfilading Gershelmann's line contributed greatly to the success of Kuroki's first day's operations at Liao Yang.

On the other hand, there are plenty of instances of Japanese soldiers being stopped by accurate fire, and a few of their failing to respond to their officers' call for an advance. And, as the war progressed, the instances of reckless daring in mass diminished. They are admirable soldiers, will attack with zest and resist to the end; they are cheerful under hardships; they have great endurance. But it is not believed that they differ from soldiers of other races who have enthusiasm for the cause and confidence in their leaders, and they have produced no army of higher spirit or greater endurance than the American army that marched to the Rhine.

A picture has been drawn of skillful, aggressive and unselfish leadership and of loyal response from the troops that is believed justified by the facts of history. But while these traits, combined with the absence of organization and consistent leadership of their opponents, gave them an unbroken series of victories in the last war, an analysis of their methods seems to indicate that the same careful staff work and an equal fixity of purpose on the other side might have reversed the results.

Oyama may have been influenced but certainly was not dominated by the doctrines and maxims of other leaders. He did not hesitate to plan and execute a strategic concentration upon the selected battlefield under conditions that made it certain his plan would become known. His plan yielded to the enemy the advantages of interior lines, with far better means of supply and movement. By all rules his armies should have been beaten in detail long before they could effect their concentration facing Liao Yang. Not one of them but was immobilized from time to time by supply difficulties, while the railroad and better roads left the Russians free to move.

In the larger engagements we find conclusive evidence of planning the action in detail, and depending upon the success of each step contributory to the final object. Instances multiplied where a

perfectly logical reaction on the part of the Russians would have forced a complete change of the rather complicated plan and with grave danger of disaster.

The double envelopment has been condemned for the smaller force. Oyama did not hesitate to use it, and it is to be seen also in some of the independent operations of Kuroki.

All great leaders have stressed the importance of saving reserves until the crisis of the action. We find, not only Oyama, but all of the subordinate commanders committing reserves very early in an engagement, invaribly before the outcome could be foretold and frequently in the first contact of the main forces. In all of the larger battles there were periods when the Japanese had put in practically every unit, and in all (except the Sha-Ho) they were over-extended at the same time, while the Russians still had large (though rather disorganized) reserves of fresh troops.

We are told that the greatest effort is to be made in the decisive direction and area—this maxim had, apparently, no weight with Oyama. At Liao Yang and to a lesser degree at Mukden he concentrated his mass in a portion of the field where no decision could be expected logically, where no great result could come from success, depending upon comparatively small forces to influence the retreat of the enemy; forces so distant as to be almost beyond his immediate control.

On the other hand, he followed the maxim about adherance to a plan once adopted. None of his subordinate commanders received contradictory orders, none was embarrassed by sudden changes, none was left in doubt, none left idle. In his brief written orders, regardless of success or failure in attaining the day's objectives, and regardless of what the enemy might be attempting, the following phrase is generally to be found: "The intentions of the Commander-in-Chief are unchanged."

Neither he, nor his army commanders, would ever yield the initiative. Should the enemy develop great strength and aggressiveness in one portion of the field, even though success might have serious results, the action was always to expedite, and (if reserves were available) to strengthen the attack *elsewhere.*

Oyama opened neither of his main offensive battles in the direction he expected to obtain a decision. In both he developed an attack of sufficient strength to appear serious on the opposite flank and continued it until it was apparent that his opponent had committed many of his reserves. Then came the decisive movement, a wide turning or a double envelopment, unless he decided upon an intermediate stage consisting of a holding attack in the center with light, extended forces. Both at Liao Yang and Mukden a well plan-

ned counter-attack through the center would have separated the Japanese forces and cut off supplies from at least one wing.

Only rarely was the Japanese attack as strong as it seemed; the enemy, not unnaturally, could not credit the fact that, in the opening of a long engagement, their enemy would commit practically all reserves to the line. They could not believe that Kuroki (at Liao Yang) isolated on the north of the Tait-zu, would extend four brigades over a ten-mile front in the endeavor to outflank and threaten the retreat of superior forces then vigorously counter-attacking him in a direction where failure to hold would cut him off from hope of reinforcement. Almost invariably the Russians exaggerated the strength of the forces along the entire line, whereas the simplest staff work should have shown them the true condition.

In the lesser battles the same strategic and tactical conception is to be observed. In only one of the engagements (Tashihchiao) was a frontal attack depended upon for a decision. In all others the frontal attack held attention while a large portion, if not the bulk, of the forces were sent on wide turning movements or (Motienling) a double envelopment. Even in the smaller affairs (see Chiao-Tou) this method was habitual. A counter-attack delivered from four to six hours after the first advance of the Japanese would frequently have found only a small force in front and covering the line of communications. The remaining forces were generally scattered in small detachments with poor means of communication and such supplies as could be packed over inferior trails.

Another noteworthy characteristic was the night movement and attack, especially in terrain where artillery support could not be assured. The night attack, also, almost invariably followed failure of the day assault, *provided success at that point was essential to the plan.* Oyama's evening orders frequently contained the directive "*Such unit* will endeavor to carry —— tonight." Had the Russians after repelling a day attack, assembled and disposed reserves to meet a night attack they would have saved many a key point. And, in those cases where the night attack did not follow, had they utilized the reserves so assembled for a determined advance the following morning they would have found, almost invariably, only a shell in front; that the bulk of the forces that had attacked the day before had been withdrawn for use elsewhere.

There is no doubt that this shell would have fought bitterly. It is to be noted that when the Japanese Infantry retired, they did so on a position that was marked to be held, that where the position occupied was really important *they did not retire.* One company held against a battalion at Motienling, and, near Chiao-Tou, a single company fought against eight, and, strengthened by the arrival of

two more companies, fought for four and a half hours until relieved. A larger example is that of the 12th Brigade and Guard Kobi Brigade at the Sha-Ho, opposing the 1st and 3rd Siberian Corps, reinforced by the cavalry of Rennenkampf and Samsonoff. Frequently the Russians had the *force* to overwhelm them—but lacked the staff to analyze their enemy's combat methods.

Considering the character of the terrain and the scarcity of telephone communication, the liasion was remarkable. It is astonishing to see how promptly Oyama gathered information of events, and how quickly reaction in one portion of the line followed success, failure, or threatened reverse in another. Doubtless another war will find far more extensive use of electrical communications, and it may well be that the Japanese cavalry will gain in prestige by those brilliant surprise actions we expect of that arm in open warfare. But we should not criticize success, and the Japanese cavalry did their full share in the success of these battles; incidentally its use tends to confirm the view that the Japanese are not tied down by prevailing ideas; that they prepare what they need and use it as they deem most advisable. As noted they still have a considerable cavalry detachment with the division.

It has been frequently remarked that in no battle did the Japanese exploit their success, that invariably the Russians made good their retirement, and that only at Mukden was the retirement seriously threatened; in brief, that the Japanese were capable of any exertion up to the time the full fruits of victory were to be gathered, then failed of the final effort. Our principle of the objective—the destruction of the enemy armed forces—was not followed out. The Clausewitz doctrine—that the army which inflicts the greatest losses really wins regardless of who holds the battlefield and provided both are left intact to fight again—was equally discarded. The Japanese were satisfied with actual mastery of the battlefield.

History may show a possible explanation of this. There is no recorded instance of a Japanese army losing a battle to a foreign enemy. Minor reverses, yes, as witness the capture of Tsusima by the Koreans; the abandonment of a campaign, yes, as witness the many failures to hold Korea; yielding the fruits of victory, yes, as witness the retirement from Port Arthur and the Liao Tung after the Chino-Japanese War, on demand of the European powers; but a pitched battle of opposing forces—never. Japanese troops have fled in panic, but it was in civil wars when their opponents were also Japanese.

This tradition of invincibility when facing a foreign foe may be the explanation of the failure of the Japanese to exploit their victories in the Russo-Japanese War. It would be a very unusual

man who would risk being the first soldier of his race to lose a battle to a foreign army. Only in some of the smaller engagements were the Russians decisively defeated; in most of the battles they retired from the field when there was still plenty of fight left in the men. If cornered, they might turn the tables; once they were definitely known to be retiring they were permitted to do so.

In this record of unbroken victories there is an element of weakness as well as of strength. While it undoubtedly enhances the morale of all ranks, it may explain the grave risks taken and the heavy losses accepted, sometimes without justification, considering the benefits, in order to ensure the actual occupation of the disputed field, and it may explain, as intimated above, why the final effort was not made. The plea of exhaustion cannot be accepted; *all* Japanese units had not made such efforts as that described for Matsunaga's brigade at the Sha-Ho. There was some other reason.

It may be that Oyama realized that he could not afford to lose a battle on account of the effect upon Japanese prestige. Japan depended upon loans to finance the war. Continuous success meant continued confidence, while a reverse might tighten the purse strings of Europe. This might have been the reason for resting satisfied with the appearance of victory rather than risking all to attain the reality; all well-knowing that no complete analysis could be made till after the war. The history of the Japanese move for peace, and the reasons that government took the initiative in seeking peace, tend to confirm this view. To have followed the directive from the homeland, rather than to follow his own instincts as a general, is not beyond what is known of Oyama's character and that of his army commanders.

To sum up:

The Japanese Infantryman is an ardent fighter with preference for the bayonet. He is capable of prolonged exertion, of extremely long charges and he will not yield ground he is ordered to hold;

The artillery is well trained and will take great risks to support the Infantry;

The cavalry does not attempt the rôle we deem basic—its most valuable function is contact and liasion;

The organization is built to enable the maximum strength, all things considered, to be developed in a terrain of inferior communications.

Their leaders are skillful, tireless, calm, and daring. Personal ambition seems lost in devotion to the general success;

Night movement and night combat are habitual;

There is a singular uniformity of maneuver, and of reaction in case of success or failure;

There is a tendency to complicated plans capable of disruption if opponents combine energetic leadership with skillful staff work;

There is great determination in adhering to a plan and thorough mutual confidence among leaders;

They will not yield the initiative regardless of danger at critical points;

Small reserves and early commitment of these is the rule;

They will risk anything, will drive their men to the limit and accept any losses rather than yield a battlefield; but will take no chance of forcing a counter-attack once the enemy definitely breaks off action and retires;

They are careful and analytical students of the doctrines, methods, organization and equipment of others, but accept and use only those that seem best fitted to their own problems.

A TOAST

Here's to the Blue of the wind-swept North
When we meet on the Fields of France,
May the spirit of Grant be with you all
As the sons of the North Advance!

* * * *

Here's to the Gray of the sun-kissed South
When we meet on the Fields of France,
May the spirit of Lee be with you all
As the sons of the South advance!

* * * *

And here's to the Blue and the Gray as One!
When we meet on the Fields of France,
May the spirit of God be with us all
As the sons of the Flag advance!

—*George Morrow Mayo.*

Relations of Land Power and Sea Power

By Colonel S. C. Vestal, C. A. C.

Editor's Note: *Colonel Vestal considers this subject under two hypotheses: the first where the superior land power is inferior on the sea; and the second, where the superior land power is superior on the sea. The first of these hypotheses was published in the May issue of the* Journal, *the second follows.*

AT THE beginning of Roman history, which for our purposes we may take as the year 509 B. C., Rome was one of a large number of Italian city states. Her territories scarcely extended beyond the walls of the city. She was governed by two consuls, elected annually by the freeholders, a senate of 300 life members, and an assembly of the people. The right to serve in the army and to vote at elections was limited to freeholders. To increase the number of her forces it was necessary for Rome to increase the number of her land owners.

Roman magistrates were elected by the popular vote of all Roman citizens who were present in the city on election day. Rome was lavish in conferring citizenship upon her provincials; but as the privilege of voting could only be exercised by the presence of the voters in the city, the power of the state ultimately fell into the hands of professional voters who lived in Rome upon doles furnished by the government.

Every Roman magistrate was a soldier and exercised active command by virtue of his civil office. Rome selected men for high command by electing her favorite soldiers to high civil office. Contrary to what one might expect from the writings of modern publicists, the effect of the military education of Roman statesmen, was to make her foreign policy extremely conservative and non-aggressive.

The Senate consisted of all who had filled or were filling certain high civil offices and of additional members necessary to make up the legal number, selected from the lower magistracy by a censor chosen every fifth year by the people. If the President, the Cabinet, and the Supreme Court of the United States were selected annually by popular vote, if all who were elected to these high offices passed automatically for life into the Senate, we would have a body somewhat analogous to the Roman Senate. If we could imagine an august

assembly of elder statesmen, soldiers, and sailors which should contain Mr. Taft, Elihu Root, Joseph G. Cannon, John J. Pershing, William S. Sims, Robert L. Bullard, Charles P. Summerall, John L. Hines, William S. Benson, and Hugh Rodman; if moreover, each of these individuals had filled high civil office, had served when young as officers in the army or navy and had later commanded divisions, corps, armies, squadrons, or fleets in active campaign, we would have a very clear conception of the Roman Senate in its best days, from the expulsion of the Roman kings to the establishment of the empire under Augustus. In ability, experience, mature judgment, and variety of talent, no other legislative body has ever rivalled the Roman Senate. Truly it was, as Polybius called it, an assembly of kings.

Politically, Rome's international policy was defensive. Her military policy in war was offensive. Rome did not bring on war for the purpose of making conquests. The best general proof of this is that she almost always began a war with a series of defeats; but she was invariably successful in war and never made peace after a defeat. The real explanation of her wars seems to be that she gained the contempt of her fellow nations by her extremely pacific attitude in time of peace. They regarded her as Germany regarded the United States prior to her entry into the World War and for many months thereafter; and they received the same unpleasant surprise as Germany received in the summer and autumn of 1918.

One of the basic principles of Rome's foreign policy was a deliberate repudiation of conquest as an end in itself, as something which serves only to entrap the victim in foolish, ill-judged, and chimerical enterprises. Conquest came to the Romans as an incident of war and was accepted most grudgingly. If Rome had shown the eagerness to annex every acre of land that she could have annexed, she would have been so tied down with imperial responsibilities that she would probably have succumbed to one of the primary powers.

The expansion of the Roman state was very slow. It began to the southward by alliances which Rome formed with other lowland cities to resist the attacks of the mountain tribes occupying central Italy from the latitude of Rome almost to the heel of Italy. Rome formed a confederation with these cities, with herself as the leader and coercing member. The attacks of the mountaineers, or Samnites, successively drove nearly all the cities into an alliance with Rome. The relations of Rome to the other members of the confederation bear a marked resemblance to the relations of Prussia to the smaller German states after the formation of the North German Confederation in 1866-67. When a city-state had once been driven by hard necessity to join the Confederation, it could never get out,

as Rome's treaties were made for all time; and, when Rome's foreign wars began in the year 280 B. C., the greater part of Italy south of Rome was within this unbreakable Confederation. It should be noted that Rome did not tax her allies, in the period under consideration; and she made no effort to administer their territories. The faithfulness of Rome's allies came as a complete surprise to Hannibal and Pyrrhus when they attacked Rome in Italy.

Rome's first contest with overseas enemies took place on Italian soil. Pyrrhus, King of Epirus, the ally of the Greek city of Tarentum in south Italy, landed 25,000 men and 20 elephants at Tarentum in the spring of 280, B. C.

The next year Rome made a treaty with Carthage in which each state pledged itself not to make a separate treaty with Pyrrhus; but the two nations did not fight as allies. The Carthaginians were content for Pyrrhus to ravage southern Italy, so long as he did not become too strong; and the Romans were not averse to seeing Pyrrhus depart for Sicily, which he did in 278. After three years of war with the Carthaginians in Sicily, Pyrrhus returned to Italy, was beaten by the Romans in a great battle, and finally returned home in 274. The Romans continued the war against his allies and soon established their authority over southern Italy.

From the beginning to the end of her history, Roman policy was largely dominated by fear of the attack of northern barbarians. For more than two centuries she maintained a row of buffer states whose southern borders were only two or three days' march from the city, as a protection against the barbarians; but when, in 285, the Gauls crossed the Appenines and one of the buffer states chose war against the Romans rather than war against the Gauls, Rome saw the futility of attempting to protect herself by weak buffer states; and she pushed her military frontier north to the Arno on the west coast and the Aesis on the east coast, where it lay in 264, when the First Punic War broke out. The Romans were now masters of Italy from the Arno to the Sicilian straits. It had taken two and a half centuries to bring about this result.

Rome's wars with Carthage furnish analogies and comparisons which throw much light upon the military and naval relations of the great powers today. When the first Punic War broke out in 264 B. C., Rome was a continental, land power, without naval forces, but possessed of an army practically invincible on land. She had recently defeated and driven from Italian soil the best Greek troops led by a general brought up in the school of Alexander the Great.

Carthage was a sea empire holding possession of Corsica, Sardinia, western Sicily, the Balearic Isles, and a vast ill-defined region in north Africa. Her land forces were inferior in number and qual-

ity to Rome's levies and she could not hope to defeat the Roman troops on Italian soil, nor Greek troops in any of the succession states of the empire of Alexander the Great; but she was mistress of the western Mediterranean. So long as she held command of the sea she could continue to build up a sea empire by conquering secondary states, and she could limit the overseas conquests of the primary states, particularly Rome.

The first Punic War lasted twenty-three years, gave control of Sicily to Rome, and disclosed the secret of world empire to the Romans. It taught them how, by a combination of superior land power and superior sea power, they could impose their will upon other nations.

The war was carried on chiefly in and about Sicily. The Romans soon felt the need of a fleet and proceeded to build one with Roman thoroughness. In a great sea fight off Mylae in the fourth year of the war, 260 B. C., they sank or captured the Carthaginian fleet. In 257 the two consuls, Regulus and Volso sailed for Africa with 40,000 men in a fleet of 330 ships manned by 100,000 sailors. Enroute they met and defeated a Carthaginian fleet of 350 vessels off Ecnomos, manned by an equal or greater complement, in the greatest naval battle of history, if the number of combatants engaged be taken as the standard of comparison.

The Roman army landed in Africa, overran the country, and captured and sent 20,000 slaves to Rome. The Carthaginians sued for peace. Regulus offered terms which showed that he comprehended the consequences which follow when a country with an invincible army gains command of the sea. He proposed that Carthage should become a dependent ally of Rome and should keep only such vessels as were required by Rome in her wars. In its confidence, the Roman Senate recalled its forces, except 15,500 infantry and cavalry, which were left in Africa under Regulus. The Carthaginians gathered together their forces, defeated Regulus and captured all his troops, except 2000 men, who took refuge on the bay of Clupea. When the news reached Rome, a fleet of 350 vessels was sent to Africa. It defeated a Carthaginian fleet and sank or captured 114 vessels. But it brought no reinforcement; for it came only for the purpose of withdrawing the garrison of Clupea. On the return voyage, three-fourths of the fleet was lost in a storm. Both sides reinforced their armies in Sicily and the miserable indecisive war was renewed in that island. The withdrawal from Clupea entailed the continuance of the war for fourteen years, and if rightly understood, the terrible war with Hannibal. When Scipio landed in Africa fifty-two years later he occupied the ground which the consuls should have occupied for the summer campaign of 256.

Ill-luck pursued the Romans at sea. Within a period of six years they lost four fleets, three of them by storms, three of them with armies on board. After the destruction of the last Roman fleet in 249, both sides relaxed their efforts at sea. The cause of Carthage was sustained by the personal capacity of Hamilcar Barca, her commander in Sicily. Finally, in the 23d year of the war, a band of patriotic Roman citizens built a fleet of 200 vessels by subscription and manned it with 60,000 sailors.

This fleet gained an overwhelming victory over the Carthaginian fleet off the island of Aegusa on March 10, 241; the Carthaginians crucified their admiral and authorized Hamilcar to make peace with the Romans. By the terms of the treaty, the Carthaginians ceded the western part of Sicily and the Lipari Islands to Rome and agreed to pay an indemnity of 3200 talents ($4,000,000) to Rome, one-third at once and the rest in ten annual installments.

The most important result of this war was the discovery made by the Romans that they were invincible upon the sea as well as upon the land. Henceforth no nation was safe from their attack; and the possibility of maintaining a *modus vivendi* among a number of independent states was at an end. If Carthage, the weaker power on land, had retained command of the sea, she would not only have been able to defend her own territory, but she could have assisted the other primary powers against Rome; and Macedonia, Greece, Egypt, and the kingdoms of Asia would most probably have retained their independence.

The situation invites comparison with conditions which have prevailed in Europe since the time when England realized that she could not compete on land in the continent of Europe with the formidable land powers of the continent. When England, at the close of the middle ages, was compelled by military weakness to renounce her ambition to establish her ascendancy upon the continent of Europe similar to that which had formerly belonged to Rome (she set herself the task, consciously or unconsciously, of preventing any other nation from dominating Europe. She has done this by her ability to control the sea and has thwarted the designs of every would-be conqueror of Christendom—Philip II, Louis XIV, Napoleon, and William II.

There seems to have been nothing in the treaty of 241 which restricted the right of Carthage to build a navy; but henceforth she renounced her ambition to control the sea; and Rome became to the contemporary world what Spain under Philip II, France under Louis XIV and Napoleon, and Germany under William II, would have been to the modern world, if they had beaten the English at sea.

Within a period of sixty years after the battle of Aegusa, Rome had reduced every primary state to the position of a secondary state; but to the credit of her statesmen, it must be said she attacked none of them. Her political policy was pacific and unaggressive; but her military policy in war was the unlimited offensive, when once she was aroused by a few preliminary disasters with which she began most of her wars.

In the interval between the First and Second Punic Wars, the Gauls twice attacked Rome. In the second foray, in 225 B. C., a large force of Gauls reached Clusium, three days' march from Rome. The Romans were thoroughly aroused: they drove back the invaders; and then addressed themselves to the conquest of north Italy. In 222 the Romans had carried their military frontier to the Alps. They were building roads and settling the conquered territory, when, in 218, they were interrupted by the arrival of Hannibal in Italy.

Everybody is familiar with the story of the Carthaginian conquest of Spain by Hamilcar Barca, and by Hasdrubal, and Hannibal, the son-in-law and son of Hamilcar, for the purpose of establishing a base on the continent of Europe for a war against Rome. Rome was aware of the hostile intentions of the Carthaginians. She became alarmed, and, in 226, she secured a treaty with Hasdrubal whereby the Carthaginians agreed not to cross the Ebro in arms. As a further measure of security she entered into a defensive alliance with Saguntum, a Greek city, one hundred miles south of the Ebro.

When at length Hannibal attacked Saguntum, Rome failed in her duty to support Saguntum; she contented herself with protests; and, after a siege of eight months Hannibal took the city. Then and not until then, the Romans sent an ultimatum to Carthage and, upon its rejection, declared war. Hannibal had hoped to draw forth a declaration of war from Rome; and, Bismark-like, he succeeded. The design to invade Italy by way of the Alps was a profound secret of the Barca family; and the march of Hannibal through Gaul which was not discovered until he was crossing the Rhone, came as a complete surprise to the Romans. Hannibal purposed to destroy Roman sea power by victories on Italian soil.

Rome planned to send, in the summer of 218, an army of 24,000 men under the consul Publius Scipio to Spain, a somewhat larger army under the consul Sempronius to Africa, and a third army under a praetor to the valley of the Po. Scipio, on his way to Spain, put in at the mouth of the Rhine and heard of Hannibal's crossing the river. His cavalry had a skirmish with Hannibal's cavalry, but when he marched up the river, he found that Hannibal had departed for the Alps. Scipio sent his army to Spain under his brother Cneas and returned to Italy to reorganize the forces to

meet Hannibal when he should emerge from the Alps. The army of Sempronius was recalled and sent north against Hannibal.

Hannibal arrived on the Po with an army of 26,000 men and 37 elephants; but he was soon joined by the Gauls who, from first to last, furnished him 60,000 infantry and 4000 cavalry. Late in the year he defeated the Romans on the Trebia, inflicting upon them a loss of 20,000 men. In the spring of the next year, he started on a leisurely march for south Italy. He entrapped a Roman army at Lake Trasimene, killing 40,000 men; spent a month on the shores of the Adriatic, reorganizing his army after the Roman model and rearming his African Infantry from the spoils of the battlefield; and then he continued his march unmolested. The next year (216 B. C.) he gained the most complete and striking victory of recorded history at Cannae, where 70,000 out of 76,000 Romans lay upon the field. Eighty-one Roman senators fell at Cannae.

One-seventh of the Italians of fighting age had fallen. Two young military tribunes, Appius Claudius and Publius Scipio, the future conqueror of Hannibal and son of the pro-consul commanding in Spain, rallied the fugitives from the field of Cannae; the consul Varro joined them; and thus two legions were gradually collected, and a third was sent down from the fleet at Ostia. For some time these were the only troops that could be opposed to Hannibal, who was expected daily before the gates of Rome. But he did not come, because his invasion of Italy was merely a hugh raid of cavalry, infantry, Balearic slingers, elephants, and pack-trains, without artillery or seige material, bearing little resemblance to the systematic invasions of Alexander, who could besiege cities as well as win pitched battles. Hannibal depended for success upon open field fighting and the treachery of Rome's allies. The Roman armies were safe within their fortified camps and the cities within their walls. Information came later in the year that the Gauls had destroyed a Roman army on the march by felling trees upon it. But the gloom of this year was relieved somewhat by good news from Spain. The Scipio brothers, Publius and Cneas, had totally defeated Hasdrubal Barca (the brother of Hannibal) on the Ebro, which would prevent him from marching through Gaul to the aid of Hannibal in Italy.

Shortly after Cannae, Hieronymus, king of Syracuse, joined the Carthaginians and ordered his fleet to aid the Carthaginians; and Philip V of Macedonia, made a treaty with Carthage whereby he agreed to land an army in Italy. Thus within three years after Hannibal had crossed the Alps, Rome found herself at war with enemies in the following geographical areas, which for all practical purpose were so many separate, independent nations: Africa, Spain,

Sicily, Macedonia, with the Gauls on the Po, and with Hannibal in south Italy. Here was a real world alliance against a continental power, whose territory was limited within very definite bounds in central Italy. It is instructive to compare this alliance against Rome with somewhat similar alliances against Spain, France, and Germany in modern times. Politically, Rome held the position of Spain under Philip II, France under Louis XIV and Napoleon, and Germany under William II, in that she was the mighty land power against which the weaker nations united; but strategically and tactically, she occupied the position of the allies in modern wars as she held command of the sea. As she did hold command of the sea, no Macedonian and few Carthaginian soldiers were landed in Italy; and she was at liberty to make war, or refrain from making it, in the countries outside of Italy, as suited her purpose. She triumphed over her numerous enemies because she was able to divide them and attack them one by one. In modern times, the allies have had command of the sea and they have triumphed because they could combine their efforts against the common foe and isolate him from the resources of the neutral world.

The Romans had a most effective and complete command of the sea in this war. Whilst they were able to transport armies freely by sea, both Hannibal and his brother, Hasdrubal, led their armies to Italy by the long and perilous land route over the Alps; but there were instances of the evasion of the Roman fleet, of which Hannibal's return to Carthage by sea is the most striking example.

The Romans made a most excellent use of their command of the sea. They sent an army to Sicily, besieged and took Syracuse, the most magnificent of Greek cities, and finally expelled the Carthaginians from the island in 210; they sent a division to Macedonia, raised a coalition of Greek states against Philip and harrassed him until he was glad to make peace in 205; they maintained an army in Spain and, after many defeats and victories, they expelled the Carthaginians from Spain; and finally, they invaded Africa, forced the recall of Hannibal, and compelled Carthage to make peace.

Hannibal's troubles began after Cannae. He suddenly found that he had a frontier to defend and allies that demanded his protection. His territory embraced south Italy as far north as Voltunus and Mons Garganus. He found himself on the defensive. Roman armies were penetrating his territories and relieving fortresses. Whenever a Roman army became too venturesome he destroyed it; but in 210 Marcellus fought a drawn battle with him and in 209 gained a victory, but in this same year, 209, Hannibal destroyed a consular army and killed the consul.

After the defeat and destruction, in 207, of the army of Hasdrubal, who had passed around the northern extremity of the Pyrenees and crossed the Alps, Hannibal retired into the land of the Bruttians, whose ports would enable him to withdraw to Carthage.

The final battle, fought on the plain of Zama, near Carthage, in 202 B. C., was so complete that Rome could dictate such terms as she pleased to Carthage. Carthage was required to cede to Rome her possessions in Spain and the Mediterranean; to deliver up her elephants and all but ten of her warships; to restore the throne of Numidia to Massinissa, whom Rome proposed to support as a rival African power against Carthage; to pay an annual tribute of 200 talents($240,000) for fifty years; to wage no war against Rome or her allies, nor beyond the limits of Africa at all, nor in Africa beyond her own territory, without the permission of Rome; and, perhaps, to furnish auxiliary ships to the Roman fleet. It will be observed that Rome limited the fleet of Carthage to a definite number of ships; but she made no attempt to prescribe the strength of the Carthaginian land forces. She merely prescribed what Carthage would be permitted to do with her army. She did annex Spain, in order to prevent it from becoming a base of operations for a new war in Italy, but she took not a foot of African territory. Spain became a costly, rebellious province which required the presence of a regular garrison of 40,000 men. It did not become self-supporting until the age of Augustus, nearly 200 years later.

One effect of the practical military education of every Roman statesman was that the question of annexing territory dependent almost wholly upon whether or not the new territories possessed good natural frontiers. The Romans at the time of the Punic wars and for many years thereafter religiously avoided transmarine possessions upon the mainland of the great continent which could possibly bring them into direct contact with a primary power or with untamed savage tribes. Such possessions would compel them to maintain large forces constantly under arms; and the cost of the garrisons would be greater than any possible economic advantages that might be derived from them. Islands stood upon a different footing. The command of the sea in all ages has enabled its possessors to hold islands with such troops as are required by the needs of domestic tranquility in the islands; and command of the sea was a cardinal principle with the Romans after their first war with Carthage. Hence we see that while Rome never hesitated to annex an island, she withdrew time after time from territories on the mainland which her armies had overrun and conquered in her wars.

Two years after her victory at Zama, Rome joined a coalition of powers formed to resist King Philip V of Macedonia, who had

begun a career of conquest. Rome sent two legions to Greece under her proconsul, Titus Quinctius Flamininus. In 197 her forces gained an easy and decisive victory over the Macedonian phalanx, to the infinite surprise of the Greeks. In the peace which she dictated to Macedonia, she left Macedonia proper, practically undiminished, but she required Philip to give up his possessions in Greece, Thrace, the Aegean, and Asia, to conclude foreign alliances only with the consent of Rome, to make no war against civilized states outside of Macedonia nor against Rome's allies at all, to reduce her army to 5000 men, to keep no elephants and not to exceed five war vessels, to give up all surplus war vessels to the Romans, to enter into a defensive alliance with Rome and to furnish contingents when required, and to pay a contribution of 1000 talents ($1,200,000).

To dispel all doubt as to the good intentions of the Romans, a herald at the Isthmian games of 196 proclaimed that:

The Roman senate and Titus Quinctitus, proconsul and imperator, having conquered King Philip and Macedonia in war, declare the following peoples free, without garrison or tribute, in full enjoyment of the laws of their own countries: namely, Corinthians," etc., (nine states named).

Flamininus spent two years in Greece in reconciling the jarring states and adjusting their diffierences. Whilst negotiations were taking place, Sparta ran amuck, and the Romans smashed her army. Rome imposed terms on Sparta similar to those imposed on Macedonia, except that the number of Spartan war vessels was limited to two, and there was no limitation upon the strength of the Spartan army.

In the spring of 194 the Romans evacuated Greece. In accordance with a plan which she had followed in Africa, Rome took no transmarine possessions for herself but gave all territorial gains to her allies.

Scarcely had the Romans evacuated Greece, when Antiochus, King of Syria, who had crossed into Europe in 196, overran the country. He had been completely deceived by the disinterested action of the Romans in Greece. He believed that Rome had been cajoled into the Macedonian War by Rhodes and Pergamus, and that if he could retain the good will of these two states he could tear up the treaty of 196 and overrun the Greek East, just as the Germans of today believe that they could overrun Europe without exciting our interest, provided that they refrain from the use of the submarine. The presence of Hannibal at the headquarters of Antiochus was peculiarly significant to the Romans. Rome did not desire oversea possessions; but she was ready to strike down any state

that might possibly renew in Italy the horrors of the Hannibalic war. She had slept while the Barcas were preparing their base in Spain; but she was now on the alert. In 192, Rome landed troops in Greece. In 190, Publius Scipio drove Antiochus into Asia, followed him, defeated him with enormous slaughter at the cost of 324 Roman soldiers, and imposed the typical Roman peace treaty upon him.

Within a period of twelve years, Rome had imposed peace upon Carthage, Macedonia, Sparta, and Syria. The most striking feature of these treaties is the fact that she forced naval disarmament upon each defeated nation. Carthage was allowed to keep ten war vessels, Macedonia five, Sparta two, and Syria ten. Disarmament on land was a more difficult matter, because each defeated state had its own problem of domestic peace, which required the services of an army, and three of the four states were in immediate contact with barbarians. Rome desired these border states to act as buffer states between herself and the barbarians. Moreover, naval disarmament was more easily superintended than disarmament on land. Macedonia alone was limited in the size of her army; but this provision was a dead letter from the day the treaty was signed. When the son of Philip renewed the war he brought a veteran army of 40,000 men into the field.

Rome evacuated Asia in 188 and the second evacuation of Greece soon followed. Rcme took no territory, except two small islands which she retained as naval bases in the east.

In 172, the third Macedonia war came on. The Romans met disaster after disaster during three years. In the fourth year, they sent out as commander the consul Lucius Aemilius Paullus, an old and experienced soldier. The old general made his coming forever memorable by turning the enemy's flank and forcing him to give battle at Pydna, where in less than an hour the legions overcame the phalanx, June 22, 168, a date which is accurately fixed by an eclipse of the moon.

Polybius dates from the Battle of Pydna the full establishment of the universal empire of Rome. It is true that Roman sovereignty and government extended only over Italy, Spain, and a number of islands in the Mediterranean; but she had destroyed every primary power in the civilized world, and henceforth, for seven centuries only shifting nomads and the intractable Parthians successfully disputed the decrees of Rome and there was only one free will between the Euphrates and the Atlantic. Rome was the one great primary power in the world, surrounded on every side by barbarians and secondary powers.

After the fall of Macedonia, Rome did not hasten to absorb the secondary states which lay within her grasp. Paullus organized Macedonia into four autonomous republics having unicameral representative governments. Macedonia did not become a Roman province at this time; but Rome disarmed the Macedonians and took over the defense of the northern frontier against the barbarians. About twenty years later, at the end of the fourth Macedonian war, Rome formally annexed Macedonia. About the same time, the Romans who had again occupied Greece during the Macedonian troubles, carried out their third evacuation of the country. More than a century was to elapse before Greece became a Roman province. Athens was never placed under the fasces of the Roman governor, and she never paid tribute to Rome.

The impetus for the annexation of the secondary nations came not from the Roman Senate, but from a series of popular leaders and revolutionists. That series includes the names of Tiberius and Caius Gracchus, Marius, and Julius Caesar.

Tiberius Gracchus, the leader of the People, first advocated a policy of annexation, such as Japan and most of the European governments have pursued in modern times and such as we ourselves pursued prior to the Civil War. Gracchus, in the year 133, urged that with plenty of freemen to fill their armies, the Romans would soon become the masters of the rest of the habitable world. He effected small conquests in Gaul and eagerly accepted the Kingdom of Pergamus in Asia, which the last king had bequeathed to the Romans in his will.

Civil strife and foreign annexations marked the period from the time of Tiberius Gracchus until the Roman dominions were united under the personal rule of Octavius Caesar, better known by his title of Augustus.

The Roman province of Africa was taken over at the end of the Third Punic War, 146, B. C.; Achaia, the same year; Pompey annexed Syria and other possessions in Asia in 61; Caesar annexed the greater part of Gaul in 56; Augustus annexed Pannonia in 35 B. C., and Germania, Moesia, and Egypt in 30 B. C., and Rhaetia and Noricum, 15 B. C.

Sea battles played a small part in the wars of this period. Rome had long since destroyed every navy in the world. The Mediterranean had become a Roman lake, which was effectually controlled by her naval forces.

When Rome ceased to fear any primary power, she allowed her navy to fall into decay; and the command of the sea passed into the hands of pirates. The evil beame so bad that Pompey in 65 B. C., was given command over the Mediterranean and over the coast

for fifty miles inland, with authority to raise 120,000 infantry, 7000 cavalry, and 500 ships of war. Pompey accomplished his task within three months.

Pompey was the uncrowned emperor of Rome from 70 to his defeat by Caesar at Pharsalia in 48. Caesar ruled for four years. After the defeat of Pompey at Pharsalia, the sons of Pompey took to sea. They commanded an effective naval force and caused no end of trouble to triumvirs, Octavius Caesar, Mark Antony, and Lepidus, who divided the Roman world amongst themselves in 43. Octavius despoiled Lepidus of his share of the empire and overthrew the last of Pompey's sons in 36; and the Roman world was divided between Octavius and Antony, somewhat on the lines of the later division between the eastern and western empires.

There were now two rival military and naval powers. The defeat of Antony in the naval battle of Actium on the coast of Epirus, August 1, 31 B. C., ended the rivalry and established Octavius as the ruling personality in the Roman state. When Augustus became undisputed master of the Roman world, he set himself the task of establishing order, effiiency, and economy in the government, and security of life and property within the empire. He crushed all opposition in the Roman state. He sold whole tribes into slavery and forced others to migrate. He waged war on the mountaineers in the Alps and in Spain, built roads and harbors, and made settled life possible for the first time over a large part of south Europe, western Asia, and northern Africa. The great endeavor of his reign, which lasted 43 years, was to reach secure frontiers on every side; and he bequeathed as a valuable legacy to his successors the advice to confine the empire within those limits which nature seemed to have set as its permanent bulwarks, namely the Atlantic, the Rhine and Danube, the Euphrates and the sandy deserts of Arabia and Africa.

The Romans conquered and expanded as a republic. The emperors were content, with few exceptions, with the boundaries which had been acquired by the republic.

The military peace establishment of the successors of Augustus consisted of approximately thirty legions, each of which, with its attendant auxiliaries amounted to about 12,500 men, or a total of 375,000 men. The emperors maintained two main fleets, one at Ravenna on the Adriatic and the other at Misenum in the Bay of Naples. They had smaller fleets at Frejus on the coast of Provence, on the Euxine or Black Sea, on the Channel, and on the Rhine and Danube. The task of these forces was to protect the frontiers against the raids of barbarians and to maintain the domestic peace of the empire, whose greatest length from east to west was 3000 miles and whose greatest breadth was about 2000 miles. The area

of the empire was about 1,600,000 square miles and the population about 120,000,000.

I wish to draw attention to a marked distinction between the policy of Rome in the days when she was struggling with the primary powers in the Mediterranean world and that of the ambitious states of the modern times. Rome overthrew the primary powers without any desire to annex their territories. Not until the age of Pompey, Crassus, and Caesar, a century after she had overthrown her last great rival at Pydna, did Rome deliberately send forth expeditions to gather the spoils of the secondary states which she had left untouched upon her frontiers. Unhappily for the truth of history, men have agreed in ascribing the political policy of this later period of Roman history to the earlier era. In the earlier period, Rome was attacked by powerful neighbors. That she should have overcome them and trod on their necks and ruined their works and that she should have disdained to appropriate their spoils, strikes one as unnatural and reads like a fable; but she owed her ultimate success in the world to her wise policy of caution. There can be no doubt that Rome's ultimate decadence and downfall were due in a large measure to over-expansion; but this over-expansion was not carried out by the able men who made it possible. Philip II, Louis XIV, Napoleon, and William II learned their policy from Pompey, Crassus, and Caesar, rather than from the Roman consuls who destroyed the primary powers of the ancient world.

I need hardly point out how closely our policy resembles the early Roman policy. We have accepted islands in the Atlantic and in the Pacific; we have taken over Alaska and Panama, which are insular in character; and we have refused continental possessions, which would bring us into contact with strong military powers.

Our two withdrawals from Cuba, our return of the Chinese indemnity, our restrained attitude towards Mexico and certain other Latin-American states, and our complete withdrawal from Europe, are not pure altruism, however much the persons who were immediately responsible for our course may have thought that they were acting from motives of pure altruism. These acts were part and parcel of the highest wisdom. We often reproach ourselves with having no policy. It seems to me that we have a very wise policy, though we may not know it. Our policy is wiser than our views of it.

Rome conquered the ancient civilized world because she combined superior land power and superior sea power. This is the great strategical lesson of her history. The great coalition wars of modern times, in one of which we bore an important part, have all been directed against nations that have tried to combine superior land power and superior sea power.

The Battles of Ludendorff On the Russian Front*

By GENERAL HUBERT CAMON, *French Army*

Translated by Captain E. M. Benitez, C. A. C., and reprinted by special arrangement with Berger-Levrault, publishers of *Revue Militaire Generale.*

EDITOR'S NOTE: *General Camon served for many years as Instructor and Director at the Artillery and Engineer School of Application at Fontainebleau, and as Assistant Commandant at the Ecole Polytechnique. In 1913 he was promoted to Brigadier General and made Chief of Artillery of the 14th Army Corps at Grenoble, in which capacity he sehred during the early part of the World War. Thereafter he served as Inspector General of Artillery Munitions Factories. His writings include "A Summary of the Campaigns of Napoleon," "Napoleon's Theory of War," "Battles," and "The Breakdown of the German Plan in September, 1914." General Camon is recognized as an authoritative military writer.*

THE strategy of Ludendorff shows a remarkable similarity to that of Napoleon, whose successes were largely due to his maneuvers against the rear of the enemy's army. But does he show the same preference for the Napoleonic scheme of battle? Let us find the answer to this question by analyzing his three great battles at the Eastern Front in 1914-1915, namely, the Battle of Tannenberg, Masurian lakes or Inserburg, and Augustowo.

The confused engagements, uncorrectly called the battles of Lods (19-21 November, 1914) and Vilna (September, 1915), which resulted from the maneuvers of the German and Russian armies, can hardly be called battles. We will discuss them briefly however to show the logical sequence of events caused by these operations.

It seems necessary also that we form a basis of analysis of Ludendorff's battles by bringing back to our minds in a few words the schemes of battle of those great warriors of the past, who served as an inspiration to Ludendorff as well as to Moltke and Schlieffen.

Victory is the problem of battles, whether it be attained with an army numerically superior or inferior to that of the enemy.

Let us see, then, how this has been accomplished throughout the centuries.

THE SYSTEM OF HANNIBAL AT CANNAE (216 B. C.).—After having annihilated two Roman armies in Trebia (Dec., 218 B. C.) and at Trasimene in the spring of 217 B. C., Hannibal led his army southward into Apulia along the Adriatic coast to get supplies for his troops. Then he continued on to Sammium, followed by the dictator Fabius who was in command of the hurriedly mobilized Roman and Allied troops.

* In three parts. The two succeeding parts will appear in the September and October issues of the JOURNAL.

After having returned to Apulia, Hannibal captured the small village of Cannae, where the Romans had a large depot of food supplies. Pabius followed him, harrassing the Carthaginian army, but avoiding a battle. When the Roman command was turned over to the two consuls, Paul-Emile and Varron, the Roman army comprised 63,000 infantry and 6000 cavalry. The Carthaginian army only consisted of 40,000 men, which included 10,000 seasoned Libyan troops and 10,000 veterans of the wonderful cavalry from the Numidian desert of North Africa.

As soon as he assumed command, Varron, firmly believing that success was a certainty, decided to engage in battle in order to prevent his colleague from partaking of a glorious victory. He massed his troops on a narrow front, so as to deliver a smashing blow. His

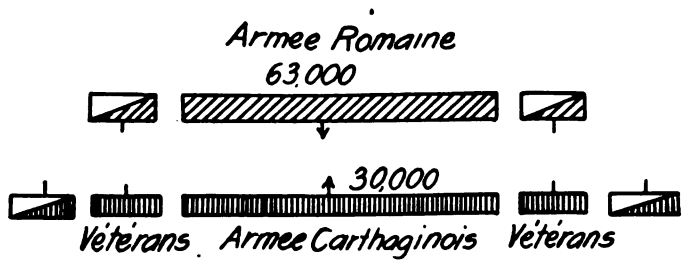

FIG. 1

DEPLOYMENT OF FORCES—BATTLE OF CANNAE

cavalry was covering the two flanks, but his 63,000 infantry occupied a front of but 1800 meters wide.

Hannibal with his 30,000 infantry, occupied a front equal in width to that of the Romans, but was deployed in about one-half the depth. His center was formed by Iberian and Celtic troops, with the veteran Libyan soldiers on the flanks, which extended beyond the Roman line. His cavalry completed the encirclement.

The Romans dashed to the attack and broke through Hannibal's center, but while the legionnaires were advancing in disorder, the African veterans fell upon the flanks of the Roman mass. The Numidian cavalry defeated the Roman horseman who opposed them, then swung around and fell upon the Roman lines from the rear. Thus the Roman Army was hemmed in. As the circle kept narrowing, those towards the center were not free to move and could not use their weapons. Retreat was impossible. The Romans left 50,000 dead and wounded upon the field, and the rest were taken prisoners.

The system of Hannibal requires forces nearly equal to that of the adversary, but if that is not possible, should plans for a victory

be given up on that account? Not by any means, because a quick blow at one point of the hostile front may produce a total disorganization, which will spread throughout the enemy forces. This system was employed by Epaminondas at Leuctra and later, when adapted to the armies of the 17th century by Folard and Marshal de Puyseguir, it served as an inspiration to Frederick II at Leuthen. It was to be finally modified by Napoleon.

LEUCTRA.—On July 8, 371 B. C., a Spartan army, composed of 10,000 infantry and 1000 cavalry commanded by King Cleombrotus, deployed in front of the Theban army commanded by Epaminondas, which was camping near Leuctra. The latter only comprised 6000 men lightly armed and 500 cavalry.

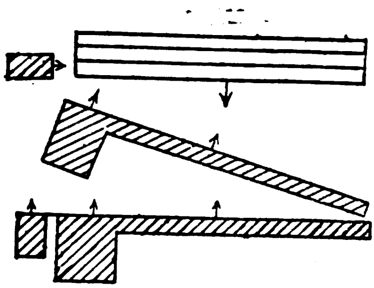

FIG. 2

FORMATION AT THE BATTLE OF LEUCTRA

Cleombrotus placed his cavalry in the first line and his infantry in the second, his line of battle having a mean depth of 12 men.

If Epaminondas had deployed his army using the same depth as the Spartan army, the latter could have easily extended its flanks and swallowed the small Theban army. However, the Theban general abstained from doing so. "He carried out," says Folard, "the stroke of a skillful and accomplished captain." His plan consisted in crushing the enemy's right by superior forces, massing against this flank 3000 infantry and his famous "battalion of the 300," that is to say, one-half of his forces, and leaving the rest of the army to prevent the enemy from sending reinforcements to the threatened flank. His front was equal to that of his enemy in width, but not in depth.

The Theban front which originally extended parallel to the Spartan front, was suddenly pivoted to the right, in order to assail the enemy's right with a solid mass. The Theban cavalry overthrew the Lacedaemonian cavalry, which was poorly organized, and the "battalion of the 300," fell upon the enemy's right. This flank, crushed by superior forces, was soon completely routed, and this de-

feat soon extended along the entire Spartan front. Clembrotus and 1000 other Spartans, comprising the flower of his army, were killed.

The system of Epaminondas is based upon a surprise attack against the enemy flank by superior forces, and upon the impossibility of its timely prevention, due to the rigidity of the formation.

The strategy used at Leuctra, was the inspiration of the one put into effect at Leuthen 2000 years later.

BATTLE OF LEUTHEN, 1757.—Up to the epoch of Frederick II, the armies were handled in such a manner, that once deployed, it became impossible to modify the maneuvers in order to meet an unex-

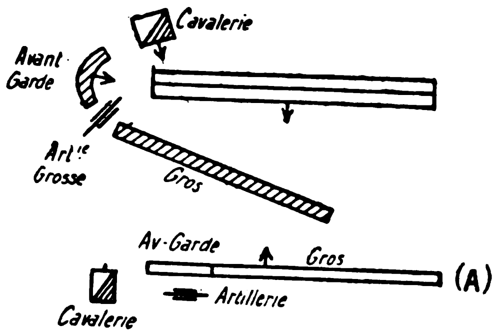

FIG. 8

FORMATION AT THE BATTLE OF LEUTHEN, DEC. 5, 1757

pected attack. Marshal de Puyseguir, desiring to see the system at Leuctra realized, conceived in his "Art de la Guerre," a tactical movement which would make it possible to concentrate sufficient forces against one of the enemy's flanks and thereby crush this flank before the adversary could bring enough troops to prevent it.

This is the plan. Deploy the army in battle parallel to the enemy front as if it contemplated an attack on the entire front, then form in column by the flank. After having done this, direct the head of the column against the enemy flank which is to be attacked and enveloped. This attacking mass is composed of cavalry, advance guard and artillery, and is supplied by the rest of the army, which in its oblique march will keep itself out of range of the enemy's guns.

Frederick arranged his army in many of his battles according to the strategical maneuvers conceived by Marshal de Puyseguir. Its triumph was the victory of Leuthen.

Napoleon, in his analysis of the battles of the Prussian monarch, states that Frederick's victories were due more to his ability to con-

ceal the approach of his attacking mass and thereby surprising the enemy, rather than to his strategical maneuvers.

Such a system assumes that the adversary should remain in a fixed position. When Soubise, at the battle of Rosebach, tried to use the same against the Prussian Army, Frederick threw himself on the former's flank, inflicting a decisive defeat.

Forty years later, during the days of the French Revolution, the armies had attained enough mobility to arrive at the desired place on time, unless they were detained for a combat along the front. Napoleon completely modified the scheme of Leuthen years later.

NAPOLEONIC BATTLE.—Napoleon's system of battle is also based upon a *main attack*. In 1794, he wrote "In all systems of

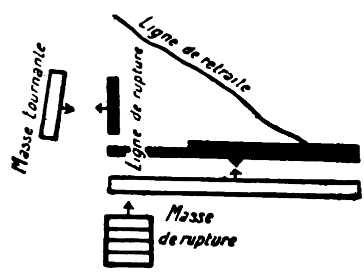

FIG. 4

THE NAPOLEONIC SCHEME OF BATTLE

warfare and sieges of fortresses as well, all forces must be concentrated at the same point. After the front is broken, the equilibrium is lost, and everything else becomes useless. It is essential not to disseminate the attacks, but to concentrate them."*

He applied this principle in his battle. Like Epaminondas and Frederick, he delivered his main blow against one of the flanks, but instead of selecting the flank which the attacking mass could more easily approach under cover, he selected the one behind which was the enemy's line of retreat. We shall presently see his reasons.

This main thrust was made after having immobilized the enemy by an attack in which the adversary was compelled to use his reserves. The French troops perfectly understood how to carry out such attack with a minimum of losses.

Furthermore, to shake the selected enemy flank, Napoleon first would throw it in disorder, materially and morally, by threatening its line of retreat with a turning attack that would take the adversary by surprise. As a result, the enemy having used its reserves in the frontal attack, was now compelled to take troops from the threat-

* From the report of General Bonaparte, army artillery commander, to young Robespierre, representative of the people, with this army.

ened flank, in order to face this turning attack, thus disorganizing the very flank which the attacking mass was about to assail.

It would be, indeed, an error to see in the combination of the outflanking and turning attacks merely a scheme to concentrate the forces, for the turning attack causes a demoralizing effect, producing a critical moment in the enemy's ranks, of which the mass which is to strike the main blow takes advantage. Marshal Saxe has said that men lose their heads when something unexpected happens, and this rule has, in general, held true in all battles.

The cavalry precedes the turning attack, forming a screen, which serves to conceal the approach of the assailing mass. The enemy is thus taken by surprise, is demoralized, and at the same time cannot bring in means with which to oppose the attack. When the assault mass is unmasked, the cavalry prepares to attack the enemy's line of retreat.

The turning mass must effectively prevent the adversary's retreat, if decisive results are to be attained. Napoleon, by his maneuvers, had already cut off the enemy's line of retreat, and inverted the battle fronts. By this time, victory was almost complete and the French army usually finished the enemy in the pursuit.

THE BATTLE OF MOLTKE.—In 1866, when Bismarck and Moltke thought that the moment had arrived for the formation of a united Germany, at the expense of Austria, the rifle and cannon had made such improvements in range, effectiveness and rate of fire, that the German General Staff believed that it was no longer possible to make a decisive attack based on the Napoleonic scheme, the moral forces of which it could not understand.

"Napoleon," wrote Schlieffen, years afterwards, "selected his point of attack and there concentrated all his available forces, trusting his success to a heroic, superhuman assault, which would open a gap and overthrow the entire enemy line."

Moltke did not believe in the possibilities of this assault. His conception was to crush the enemy by an *envelopment* with superior forces.

In 1866 and in 1870, Moltke divided his forces into three armies, influenced by the arrangement of the Prussian and Allied territories, in order to facilitate the concentration and assure the initial security of these territories. His sole strategy was the converging of the three armies on the presumed enemy concentration point.

This was a contradiction of Clausewitz' theory of "bloc," but the latter also said: "There may be situations, in which the initial division of forces and their converging march may be justified. This procedure gives, besides, real advantage, because by the converging

actions, the enemy is not only beaten, but more or less cut off. It also makes it easier to supply the troops."

Moltke's conception of battle may be summarized in these words: *immobilize and envelope.* It seemed that he did not have the slightest preoccupation in regard to an unequality of forces, nor seemed at all concerned about the direction of the battle. His strategic role seems to have been achieved after he had succeeded in converging the three armies towards the enemy.

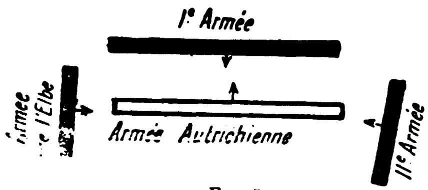

FIG. 5

FORMATION AT THE BATTLE OF SADOWA OR KONIGRATZ [JULY 3, 1866]

1866.—The German concentration took place on the Austrian frontier. The three armies:

1st Army: (Prince Frederick Charles), in Lusace.
2nd Army: (Crown Prince), in Silesia.
3rd Army: (Army of the Elbe*), in Saxony.

Moltke expected the concentration of Austrian forces at Konigratz, at the turn of the Elbe, and therefore designated this place as the converging point of his three armies.

The function of the 1st Army was plainly indicated, even forced, says the Prussian historian. It consisted in engaging the enemy in battle on the front, of attracting all the enemy forces, and resisting them firmly, in order that the double enveloping attack prepared against the two hostile flanks might succeed.

In fact, the battle was organized, unknown even to Moltke himself by Prince Frederick Charles, who commanded the 1st Army. In his ardor to attack, Frederick Charles did not await the arrival of the 2nd Army and became seriously engaged in battle by eight o'clock in the morning, suffering such enormous losses that King William seriously considered ordering a retreat. Had Benedek† advanced, the Prussians would have been defeated. The advance guard of the 2nd Army arrived at 1:30 o'clock p. m., and at 3:00 o'clock p. m., the Army itself arrived after long marches. Then the result of the battle was decided.

*TRANSLATOR'S NOTE: The Army of the Elbe was commanded by General Herwarth von Bittenfeld.

†TRANSLATOR'S NOTE: The Austrian Imperial Army, under the supreme command of Benedek stood in a wide semicircle on the upper Elbe.

The bulk of the Austrian Army escaped during the confusion that followed the converging attack of the three armies.

1870.—We still have the three armies:

1st Army: Commanded by Steinmetz, concentrated to the North of Sarrelouis.
2nd Army: Commanded by Prince Frederick Charles, concentrated to the North of Neunkirchen-Hamburg.
3rd Army: Commanded by the Crown Prince, concentrated towards Carlsruhe.

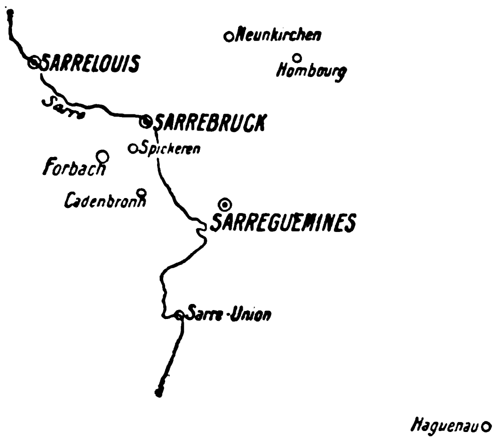

Fig. 6

The Concentration Plan of Moltke in 1870.—Line Sarrelouis-Sarreguemines

On August 23, Moltke believed that the French General Staff had decided to maintain the offensive with all available forces at a strong position behind the Sarre (Cadenbronn), to the rear of the line Sarrelouis-Sarreguimines. His plan was again to converge the three armies on this line. "The entrance of these three armies in line, for a decisive battle, is the desired end," he wrote at noon of August 4th to General Blumenthal, Chief of Staff of the Third Army.

On that same day, Moltke outlined the role of these three armies in a telegram to Steinmetz: "The 3rd Army will take the offensive in the Southern region towards Haguenau today, in order eventually to move on to the Upper Sarre; the 2nd Army will continue its movement towards the line Neunkirchen-Hamburg; the 1st Army will receive orders subsequently, either to resist or operate against the enemy left flank. The crossing of the Sarre is not contemplated

before the 9th of August. The adversary seems willing to maintain the defensive behind that river.

In fact, the French forces were not occupying the position at Cadenbronn. The 3rd Army came in contact with MacMahon's army at Froeschwillers, defeating it and pursuing the units that were left in the direction of Luneville. The French main forces withdrew towards Metz. Moltke, in order to prevent the French from escaping to Verdun, surrounded Metz on the south by the 1st and 2nd Armies, which deployed by the right in battle, facing our corps already in position on the heights of St. Privat, to the west of the besieged fortress.

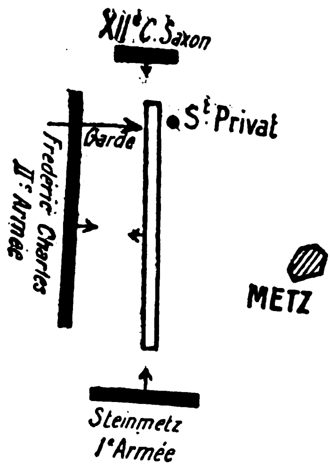

FIG. 7

BATTLE OF PRIVAT [OR GRAVELOTTE] AUG. 18, 1870

The battle was based on one frontal and two flank attacks. The front attack would be delivered by the bulk of the 2nd Army, and the flanking attacks by the 1st Army and by the 12th Saxon Corps of the 2nd Army.

Frederick Charles, desiring to decide the battle by the capture of St. Privat, ordered the Guard to attack, without awaiting for the attack of the Saxons. The Guard sustained enormous losses, and was unable to advance until the arrival of the 12th Corps. The arrival of this Corps diverted part of the forces of the French right, and then, a second attack by the Guard captured St. Privat and decided the battle.

The French troops fell back on the fortifications of Metz.

The battle was, in fact, planned in a Napoleonic manner, by a frontal attack on the flank against which the turning attack of the 12th Corps was directed. This fact passed unnoticed due to the

ignorance that existed at that time in Germany concerning Napoleon's system. The impression that prevailed was that of the Guard's hecatomb in his first attack, and the idea became stronger and stronger in all minds that the break-through of the enemy front was no longer necessary to win the battle, but instead that this would be accomplished by a double envelopment.

At Sedan, MacMahon made no efforts to prevent his envelopment.

THE BATTLE OF SCHLIEFFEN.—Schlieffen observed two things in Moltke's battles:

First: The enormous losses sustained at Sadowa (or Konnigratz) by the 1st Army, due to the desire to break through the Austrian front without awaiting for the enveloping attack of the 2nd Army, and by the Guard in the battle of St. Privat, in the first attack, without awaiting for the enveloping attack of the XII Saxon Corps.

Second: Insufficient encirclement. At Sadowa, the bulk of the Austrian army had been able to escape. At St. Privat, Bazaine's entire forces had withdrawn to the lines of fortifications. It is true, however, that these were quite close. At Sedan, MacMahon was surrounded, but in truth, the French General had, by his lack of energy, brought it upon himself.

It was necessary to find some other system.

Schlieffen discarded Frederick's system, because it was objectionable in that the adversary might execute the same maneuvers on the opposite flank.

He also discarded the Napoleonic system, whose tricks he did not understand.

As has already been quoted, he writes on this subject: "Napoleon selected his point of attack and there concentrated all his available forces, trusting his success to a heroic, superhuman assault, which would open a gap and overthrow the entire enemy line." He did not believe in the success of such tactics, on account of the enormous losses which modern armies would inflict upon assailant troops.

Schlieffen thought that the weak point of Moltke's battle, both at St. Privat and at Sadowa, consisted in having in charge of the main attack a General like Prince Frederick Charles, who persisted in breaking through without awaiting for the enveloping mass. He also thought that these masses were too weak to effect the envelopment.

A similar plan would be just as disastrous if applied to modern armies. Therefore, it is necessary to adopt an inversion of forces: Reduce the forces assigned to the frontal attack, increasing the enveloping masses. Besides, the progress of arms now permit the economy of forces in this purely demonstrative frontal attack. If the

enemy takes the offensive against this front, it will give in, but not break. And while the enemy, in spite of enormous losses, insist upon forcing the front, the enveloping masses will fall on his rear and catch him in the net.

But this was Hannibal's scheme at Cannae, practically identical to that which Count Schlieffen, Chief of Staff of the German Army, proclaimed for fifteen years. And we may well believe that it had left a deep impression on the German generals in 1914.

"The principle of the Commander in Chief," writes Stendahl, "is similar to that of the three thieves meeting a passer-by at a street corner. What good will the patrol do to the unhappy victim, if it arrives three minutes late?"

This paragraph translated into military language means, that the principle of the Commander in Chief should be to concentrate by surprise a force on the hostile front capable of completely disorganizing it. This attack must be secret and rapid. It is essential that the surprised enemy may not be able to oppose the attacking mass with forces that might cause it to fail.

We have seen the solutions of the great military leaders. That of Epaminondas, at a time in history when the order of battle, once decided upon, could not be modified; that of Puyseguir, adopted by Frederick the Great at a time when the order of battle could be modified only with great difficulty. Epaminondas and Frederick made use of quickness and surprise, the latter utilizing the terrain to this effect.

Napoleon's solution while more complex, is more independent of the terrain. It was necessary in order to reap the full benefit of his strategy that the enemy be turned back and the escape of the defeated forces be prevented.

The system of Hannibal at Cannae, adopted by Schlieffen, is based on an idea different from that of Epaminondas, Frederick, Napoleon or Stendahl. It does not aim at making a gap in the enemy front, but at a complete encirclement.

But this encirclement, either presupposes a numerical superiority, or as in Hannibal's case, requires a long stretch of front which would permit the creation of two powerful flanks, even with smaller forces.

We have seen Moltke attacking his adversary with three converging armies, but except at Sedan, these armies did not have sufficient length of deployed front to envelop the enemy. Schlieffen applied Hannibal's solution to modern armies.

We will see in Ludendorff's battles on the Russian front, the results attained by the application of General Schlieffen's doctrines.

Corps Antiaircraft Artillery on the Defensive

By Major G. A. Wildrick, C. A. C.

THERE follows a map problem which is self explanatory. It was issued for study by officers of the Second Coast Artillery District during the past winter. Field Orders No. 6, I Corps, and Administrative Orders No. 5, I Corps, can be found in "Tactical and Strategical Studies, Volume I, The Independent Corps," The General Service Schools, Fort Leavenworth, Kansas, 1924. It is noted that the antiaircraft machine guns are assumed to be of .50 caliber.

The solution is a personal one and arrived at independently. This is stressed so that no official sanction can be assumed to be attached. The solution is to the First Requirement only. The other requirements have been omitted.

General and Special Situations

The following field orders and administrative orders are issued:

I Corps,
Lancaster, Pa.,
4 May 23, 5:00 PM.

Field Orders }
No. 6 }

Maps: Geological Survey 1:62500; Lancaster, New Holland, McCalls Ferry and Quarryville Quadrangles.

1. *a.* A hostile force, estimated as a corps of two divisions with one regiment of cavalry attached, occupies an organized position extending from the road junction just south of Marticville, east along the high ground just south of Pequea Creek to hill one mile northwest of Harmony School, with a strong detached post on the high ground about one mile northwest of New Providence. The high ground southwest of Burnt Mills is held as a detached post. Enemy covering forces have been driven in on the remainder of the front and our advanced elements are in contact with his main position south of Pequea Creek and Beaver Creek. Some intrenching is being done along the ridge: Rawlinsville—Truce. Artillery has been located in the vicinity of Rising Sun School, Smithville, and road junction 651 (south of Union). A division was camped near Perrysville at noon today.
See G-2 Report and special intelligence map of this date. (Omitted)

b. Our army, advancing against the enemy west of the Susquehanna River, has reached the general line: Long Level—west to South Mountain.

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*Note: The orders of the I Corps are quoted from Chapter VIII, "Tactical and Strategical Studies, Vol. 1, The Independent Corps," The General Service Schools, Fort Leavenworth, Kansas, 1924, in which may be found additional information as may be desired.

c. The army air service supports the attack of the corps as follows:

(1) Immediately after dawn the strong point southwest of Burnt Mills and critical points in the area: Marticville—Red Hill School—hill one mile west of Rising Sun School will be neutralized with persistent gas. Gas bombardments will cease on points and at hours prescribed in paragraph 3 *d* (4).

(2) Between 4:00 AM and 4:30 AM, the strong point just east of road junction 360, the fortified high ground immediately west thereof, and the hostile artillery in the vicinity of Rising Sun School and Smithville, will be attacked with high explosive bombs.

(3) After Completion of these missions, the advance of the 3rd Division will be supported by bombing attacks on hostile supports and reserves.

2 *a.* This corps moves tonight under cover of darkness to assault positions and attacks tomorrow, enveloping the enemy's right flank.

b. Time of attack: 4:30 AM.

c. Line of departure:

Pequea Creek to Herrville—Pennsylvania RR—Herrville to Refton—Lancaster and Quarryville Electric RR.

d. Zones of action:

1st Division: west boundary: Windom (inclusive)—Rock Hill—Conestoga (both inclusive)—road junction 392—Marticville—Bethesda (all inclusive).
east boundary: Pennsylvania RR (Quarryville BR) (inclusive) from Lancaster to Herrville—BM 345 (exclusive)—Rawlinsville—Indian Rock School (both inclusive).

2nd Division: west boundary: same as east boundary 1st Division.
east boundary: Greenfield—Rockvale School—Lampeter (all inclusive)—crossroads 318—road junction 360—BM 858—Liberty Square (all inclusive).

3rd Division: west boundary: same as east boundary 2nd Division.
east boundary: Ronks—road junction 435—Oak Hill—crossroads 738 (all inclusive)—road junction 414 (exclusive) —BM 505—Buck—Liberty Square (all inclusive).

3. *a.* The 1st Division will make its main effort with its left in conjunction with the advance of the 2nd Division. It will seize in succession, the ridge Marticville—Rising Sun School, the high gound in the vicinity of Red Hill School and Union, and the ridges: Mt. Nebo—Rawlinsville.

b. The 2nd Division (less one regiment), making its main effort on its right, will penetrate up the valley of Huber Run and, by flanking action up the ravines toward Mt. Airy School, will assist the 3rd Division in securing the high ground east and west of road junction 360 and east of Smithville, after which it will push on rapidly and seize the Hickory School ridge.

c. The 3rd Division will envelop the right of the hostile position and capture in succession the high ground northeast of New Providence and in the vicinity of Mt. Airy School, and the Truce ridge. It will advance rapidly up the valley of Goff Run and will be assisted by the 2nd Division in securing the high ground east and west of road junction 360 by flanking action up the ravines to the west, and in the capture of the Mt. Airy School ridge and the Truce ridge.

d. The 101st Field Artillery Brigade will support the attack from the following positions:

101st Field Artillery, vicinity of BAUMGARDNER.

102nd Field Artillery, vicinity of cross roads one mile south of WILLOW STREET.

103rd Field Artillery, vicinity one mile east of crossroads 318 (east of LIME VALLEY).

104th Field Artillery, vicinity of crossroads 449 (one mile south of LAMPETER).

(1) These regiments will move into positions indicated *via* the road: LANCASTER—WILLOW STREET—BAUMGARDNER, and the road: LANCASTER—crossroads 279—LAMPETER; which will be cleared for their use from 8:00 PM today, until the movement is completed.

(2) The artillery preparation, in which all guns will participate, will consist of fire on enemy front lines, and on supports and reserves in rear, from 4:00 AM to 4:30 AM. Prior to 4:00 AM, artillery fire will be limited to urgent requirements.

(3) As its primary mission, the corps artillery will be prepared to concentrate fire on the hostile position immediately east and west of road junction 360. It will also execute counterbattery and such interdiction and harassing fire as will break up enemy concentrations. When not engaged on these missions it will assist the advance of divisions by fire on successive objectives.

(4) Corps artillery will employ non-persistent gas in counterbattery and to harass enemy reserves along the ravine one-half mile south of the hostile main line of resistance and on the partially organized position along the ridge: MT. NEBO—RAWLINSVILLE—TRUCE. It will also neutralize with persistent gas, beginning at 4:00 AM, the advanced post just southwest of BURNT MILLS and critical points in the area: MARTICVILLE—RED HILL SCHOOL—hill one mile west of RISING SUN SCHOOL.

Gas fire by corps artillery will cease at the following hours:

Area	*Non-persistent*	*Semi-persistent*
Along ravine south of hostile main line	4:30 AM, 5 May	(none used)
Along ridge: MT. NEBO —TRUCE	Dependent on advance of divisions	12:00 noon, 5 May

(5) Division artillery will employ smoke on hostile observation stations in the vicinity of road junction 392, RED HILL SCHOOL, hills in vicinity of RISING SUN SCHOOL, and high ground east and west of road junction 360.

Division commanders, at their discretion, may employ non-persistent gas within their zones of action, coordinating its use with adjacent divisions when used within the danger limits of division boundaries. Semi-persistent gas may be used by divisions on the high ground east and west of road junction 360.

(6) For other artillery details, see Annex No. 1, Artillery (omitted).

e. The 105th Artillery (antiaircraft) will provide gun area defense along the general line: CONESTOGA—WEST WILLOW—LAMPETER—BUNKER HILL SCHOOL.

f. (1) The 1st Cavalry (less one troop), with Troop A, 1st Machine Gun Squadron attached, from the vicinity of MT. PLEASANT, will cover the left flank of the enveloping attack, seize hill 804 (one mile northeast of QUARRYVILLE) early on 5 May, and reconnoiter to the south as far as the general line: FULTON HOUSE—KINGS BRIDGE.

(2) Troop A, 1st Cavalry, will cover our right flank from the vicinity of CONESTOGA, and will reconnoiter to the south as far as PEQUEA CREEK.

g. The air service will support the attack as follows:

(1) Air supremacy east of the SUSQUEHANNA RIVER will be maintained and hostile aerial observation will be prevented at all costs.

(2) The corps air service will maintain observation from the initial line: DRYTOWN—BUCK—ROSS HILL SCHOOL to the south. Especial attention to the roads leading north from PERRYVILLE.
Three planes will be held available for corps command use.

(3) Division air services will continue intensive reconnaissance of the hostile position to include the general line: DRYTOWN—BUCK—ROSS HILL SCHOOL. Indications of a Red withdrawal will be reported promptly to the corps.

(4) The 705th Attack Squadron will be held on the alert prepared to attack hostile supports and reserves.

(5) The 102nd Balloon Company is attached to the 2nd Division and the 103rd Balloon Company to the 3rd Division for the attack. The Balloon Group (less two companies) will observe for the Corps Artillery, and the 1st Division on call.

h. One regiment 2nd Division, as Corps reserve, will be in readiness after 4:30 AM, in the vicinity of WILLOW STREET.

x. (1) All troop movements in preparation for the attack will be made under cover of darkness and all units will be in assault positions by 3:30 AM.

(2) Every precaution will be taken to prevent the enemy from discovering our dispositions.

(3) Connection between divisions will be maintained to the right.

4. See Administrative Orders No. 5.

5 *a.* Axes of signal communication:

I Corps: LANCASTER—REFTON—RAWLINSVILLE.
1st Division: MILLERSVILLE—BURNT MILLS—RED HILL SCHOOL—DRYTOWN.
2nd Division: HOLLINGER—REFTON—HARMONY SCHOOL—SMITHVILLE—HICKORY SCHOOL.
3rd Division: STRASBURG—NEW PROVIDENCE—TRUCE.

b. Command posts:

I Corps: LANCASTER.
1st Division: MILLERSVILLE.
2nd Division: HOLLINGER.
3rd Division: STRASBURG.

By command of Lieutenant General A:
X,
Chief of Staff.

Appendices:

Situation Map, 5 PM, 4 May........ following page 108.
Operation Map, to accompany FO No. 6, I Corps, following page 108.
Annex No. 1, Artillery (omitted).
Distribution: (omitted).

I Corps,
LANCASTER, PA.,
4 May 23, 5:00 PM.

ADMINISTRATIVE ORDERS No. 5 } To accompany Field Orders No. 6.

1. SUPPLY.

a. *Railheads.*

1st Division: ROHERSTOWN.
All others: no change.

b. *Rations.*

(1) Order of distribution at railhead: no change.
(2) One surgical hospital is attached to each division for rations.

c. *Ammunition.*

(1) Corps park: all classes of ammunition at LANCASTER freight station.
(2) Distribution points for corps artillery: NEW DANVILLE and LONGNECKER CHURCH.

d. *Engineer.*

Corps park: LANCASTER.

e. *Signal.*

Corps park: LANCASTER.

f. *Medical.*

Corps park: EAST PETERSBURG.

g. *Ordnance.*

Corps park No. 1: LANCASTER—artillery and general supplies.
Corps park No. 2: BAUSMAN—small arms.

h. *Quartermaster.*

Corps field remount depot: SWATARA.
Corps park: general supplies, motor parts and reserve gasoline and oil, at bivouac of I Corps Train, ROSSMERE.

i. *Chemical Warfare.*

Refilling point: FRUITVILLE.

j. *Air Service.*

Refilling point: communications zone depot: HARRISBURG.

2. EVACUATION.

By corps.

a. *Men.*

Evacuation point: EAST PETERSBURG..

b. *Animals.*

Evacuation point: DILLERVILLE.

3. ROADS.

a. *Restrictions.*

Corps reserved road, HARRISBURG TURNPIKE, HARRISBURG to LANCASTER.

b. *Maintenance.*

By corps and divisions within their respective areas.

c. Circulation.

(1) Axial road, corps: LANCASTER—WILLOW STREET—road junction 499—REFTON—MARTINSVILLE—NEW PROVIDENCE—QUARRYVILLE.

(2) Divisions will make mutual arrangements for the control of traffic along boundaries.

4. SALVAGE AND BURIAL.

a. Salvage. No change.

Burial.

(1) Corps cemetery: HOLLINGER.
(2) Divisions will establish cemeteries.
(3) All burials will be in cemeteries where practicable.

5. BOUNDARIES.

Division rear bounderies: WINDOM—MILLERSVILLE (all to divisions)—BAUSMAN — LANCASTER — GREENFIELD (all to corps) — PHILADELPHIA and LANCASTER TURNPIKE (to divisions).

6 MILITARY POLICE.

a. Traffic Control.

By divisions within their respective areas.

b. Stragglers.

Division straggler lines along boundaries of divisions will be coordinated by divisions concerned.

7. PRISONERS OF WAR.

a. Corps cage: LANCASTER.

b. Evacuation from divisions by corps.

By command of Lieut. General A:
X,
Chief of Staff.

Official:
Y,
AC of S, G-4.
Distribution:
Omitted.

REQUIRED

1. The formal field order of the commanding officer of the 105th Artillery (Antiaircraft) in compliance with par. 3 *e*, Field Orders No. 6, I Corps.

2. A concise discussion of:

(a) The proper employment of the 105th Artillery* in the situation presented.

(b) Recommendations, if any, for the improvement of par. 3 *e* of Field Orders No. 6, I Corps.

*NOTE: The 105th Artillery (Antiaircraft) is assumed to be at full war strength and completely equipped. The machine guns are assumed to be of .50 caliber.

A Solution

105th Artillery (AA),
Lancaster, Pa.,
4 May 23, 7:00 PM.

Field Orders
No. 7

Maps: Geological Survey 1:62500; Lancaster, New Holland, McCalls Ferry and Quarryville Quadrangles.

1. See Appendix No. 1.

2. This regiment will provide gun area defense along the general line: Conestoga—West Willow—Lampeter—Bunker Hill School, and will support the corps attack.

3. *a.* The 1st Bn. (Guns) will support the attack initially from positions in the vicinity of R. J. 398 (1½ mi. N. W. Conestoga), C. R. 430 (S. E. of Willow Street) and Bunker Hill.

   Particular attention will be paid to protecting the corps artillery and the corps infantry reserve. Information of friendly and enemy aviation activity over our own troops and over the enemy position will be reported promptly.

   b. The 2nd Bn. (MG) will support the attack, employing one battery in each division zone of action. The corps artillery and reserve will be protected and the divisions will be closely covered throughout the attack. Information of friendly and enemy aviation activity over our own troops and over the enemy position will be reported promptly through the nearest A. A. gun battery, with which connection will be maintained. One battery will protect corps headquarters and installations near Lancaster, and will report aviation activity direct to Hq. 105th Arty.

   x. (1) All movements in preparation for the attack will be made under cover of darkness, and all units will be in position by 3:30 AM.
   (2) Movements within division zones of action will be arranged with the division concerned.
   (3) Every precaution will be taken to prevent the enemy from discovering our dispositions. Observation and photographic missions by enemy aircraft will be prevented.
   (4) Bombing, and other airplanes, attempting to attack our troops, will be driven off.
   (5) All units will be prepared to advance promptly.

4. (See Annex No. 1).

5. *a.* Battery communications, during advances, will follow divisional axes of signal communication. (See Annex No. 1).

   b. Axis of signal communication:
   105th Artillery (same as I Corps): Lancaster—Refton—Rawlinsville.
   1st and 2nd Battalions: Willow Street—Refton—Harmony School—Rawlinsville.

   c. Command posts:
   105th Artillery: Lancaster.
   1st and 2nd Battalions: Willow Street.

X,
Colonel.

Annex No. 1.
Distribution: I Corps—Corps AS—Corps Chief of Artillery—101st FA Brig.—1st Div.—2nd Div.—3rd Div.—105th Arty. Hq.—Serv. Btry—Hq. Btry.—1st Bn.—2nd Bn.

ANNEX NO. 1 TO FIELD ORDERS NO. 7, 105th ARTILLERY (AA)

105th Artillery (AA)
LANCASTER, PA.,
4 May 23, 7:00 PM.

1. *a.* A hostile force, estimated as a corps of two divisions with one regiment of cavalry attached, occupies an organized position extending from the road junction just south of MARTICVILLE, east along the high ground just south of PEQUEA CREEK to hill one mile northwest of HARMONY SCHOOL, with a strong detached post on the high ground about one mile northwest of NEW PROVIDENCE. The high ground southwest of BURNT MILLS is held as a detached post. Enemy covering forces have been driven in on the remainder of the front and our advance elements are in contact with his main position south of PEQUEA CREEK and BEAVER CREEK. Some intrenching is being done along the ridge: RAWLINSVILLE—TRUCE. Artillery has been located in the vicinity of RISING SUN SCHOOL, SMITHVILLE, and road junction 651 (south of UNION). A division was camped near PERRYVILLE at noon today.

   b. Our army, advancing against the enemy west of the SUSQUEHANNA RIVER, has reached the general line: LONG LEVEL—west to SOUTH MOUNTAIN.

   c. The army air service supports the attack of the corps as follows:

   (1) Immediately after dawn the strong point southwest of BURNT MILLS and critical points in the area: MARTICVILLE—RED HILL SCHOOL—hill one mile west of RISING SUN SCHOOL, will be neutralized with persistent gas. Gas bombardment will cease on points and at hours prescribed in paragraph 3 *d* (4).

   (2) Between 4:00 AM and 4:30 AM, the strong point just east of road junction 360, the fortified high ground immediately west thereof, and the hostile artillery in the vicinity of RISING SUN SCHOOL and SMITHVILLE, will be attacked with high explosive bombs.

   (3) After completion of these missions, the advance of the 3rd Division will be supported by bombing attacks on hostile supports and reserves.

   d. The air service will support the attack as follows:

   (1) Air supremacy east of the SUSQUEHANNA RIVER will be maintained and hostile aerial observation will be prevented at all costs.

   (2) The corps air service will maintain observation from the initial line: DRYTOWN—BUCK—ROSS HILL SCHOOL to the south. Especial attention to the roads leading north from PERRYVILLE. Three planes will be held available for corps command use.

   (3) Division air service will continue intensive reconnaissance of the hostile position to include the general line: DRYTOWN—BUCK—ROSS HILL SCHOOL. Indication of a Red withdrawal will be reported promptly to the corps.

   (4) The 705th Attack Squadron will be held on the alert prepared to attack hostile supports and reserves.

   (5) The 102nd Balloon Company is attached to the 2nd Division and the 103rd Balloon Company to the 3rd Division for the attack. The Balloon Group (less two companies) will observe for the Corps Artillery, and the 1st Division on call.

2. *a.* This corps moves tonight under cover of darkness to assault positions and attacks tomorrow, enveloping the enemy's right flank.

   b. Time of attack: 4:30 AM.

   c Line of departure:

   PEQUEA CREEK to HERRVILLE—PENNSYLVANIA RR—HERRVILLE to REFTON—LANCASTER and QUARRYVILLE ELECTRIC RR.

d. Zones of action:

1st Division: west boundary: WINDOM (inclusive)—ROCK HILL—CONNESTOGA (both inclusive)—road junction 392—MARTICVILLE—BETHESDA (all inclusive).
east boundary: PENNSYLVANIA RR (QUARRYVILLE BR) (inclusive) from LANCASTER to HERRVILLE—BM 345 (exclusive) — RAWLINSVILLE — INDIAN ROCK SCHOOL (both inclusive).

2nd Division: west boundary: same as east boundary 1st Division.
east boundary: GREENFIELD—ROCKVALE SCHOOL—LAMPETER (all inclusive)—crossroads 318—road junction 360—BM 858—LIBERTY SQUARE (all exclusive).

3rd Division: west boundary: same as east boundary 2nd Division.
east boundary: RONKS—road junction 435—OAK HILL—crossroads 738 (all inclusive)—road junction 414 (exclusive)—BM 505—BUCK—LIBERTY SQUARE (all inclusive).

3. *a.* The 1st Division will make its main effort with its left in conjunction with the advance of the 2nd Division. It will seize in succession, the ridge MARTICVILLE—RISING SUN SCHOOL, the high ground in the vicinity of RED HILL SCHOOL and UNION, and the ridge: MT. NEBO—RAWLINSVILLE.

b. The 2nd Division (less one regiment), making its main effort on its right, will penetrate up the valley of HUBER RUN and, by flanking action up the ravines toward MT. AIRY SCHOOL, will assist the 3rd Division in securing the high ground east and west of road junction 360 and east of SMITHVILLE, after which it will push on rapidly and seize the HICKORY SCHOOL ridge.

c. The 3rd division will envelop the right of the hostile position and capture in succession the high ground northeast of NEW PROVIDENCE and in the vicinity of MT. AIRY SCHOOL, and TRUCE ridge. It will advance rapidly up the valley of GOFF RUN and will be assisted by the 2nd Division in securing the high ground east and west of road junction 360 by flanking action up the ravines to the west, and in the capture of the MT. AIRY SCHOOL ridge and the TRUCE ridge.

d. The 101st Field Artillery Brigade will support the attack from the following positions:

101st Field Artillery, vicinity of BAUMGARDNER.

102nd Field Artillery, vicinity of crossroads one mile south of WILLOW STREET.

103rd Field Artillery, vicinity one mile east of crossroads 318 (east of LIME VALLEY).

104th Field Artillery, vicinity of crossroads 449 (one mile south of LAMPETER).

These regiments will move into positions indicated *via* the road: LANCASTER—WILLOW STREET—BAUMGARDNER, and the road: LANCASTER—crossroads 279—LAMPETERS which will be cleared for their use from 8:00 PM, today, until the movement is completed.

e. One regiment 2nd Division, as Corps reserve, will be in readiness after 4:30 AM, in the vicinity of WILLOW STREET.

4. *a.* Circulation:

(1) AXIAL road corps: LANCASTER—WILLOW STREET—RJ 499—REFTON—MARTICVILLE—NEW PROVIDENCE—QUARRYVILLE.

Insert to "Corps Antiaircraft Artillery on the Offensive."

East Petersburg
ev.m.
Fruitville
Turnpike
PENNSYLVANIA RR
ev.a.
Rossmere
LANCASTER
HQ
Baumans
Pennsylvania RR
Philadelphia and Lancaster Turnpike
Hollinger
Rockville School
Longnecker Church
Pequea Creek
Millersville
New Danville
Willow Street
104
Strasburg
3"AA
West Willow
101
102
103
105th Arty (A.A.)
Rockhill
Lime Valley
Bunker Hill School
Conestoga
Refton
Martinsville
Burnt Mills
Pequea
Mt Pleasant
Marticville
Harmony School
Smithville
New Providence
Atglen & Susquehanna Br.
1st DIV
2nd DIV
3rd DIV
Union
Quarryville
Susquehanna
Mt. Nebo
Hickory School
Truce
Rawlinsville
Buck
Ross Hill School
Drytown
Indian Rock School
Bethesda
Liberty Square
Kings Bridge
River
Scale of Miles
Fulton House

b. Division rear boundaries: WINDON—MILLERSVILLE (all to divisions)—BAUSMAN—LANCASTER—GREENFIELD (all to corps)—PHILADELPHIA and LANCASTER TURNPIKE (to divisions).

c. Traffic control: By divisions within their respective areas.

5\. *a.* Axes of signal communications:

I Corps LANCASTER—REFTON—RAWLINSVILLE.

1st Division: MILLERSVILLE—BURNT MILLS—RED HILL SCHOOL—DRYTOWN.

2nd Division: HOLLINGER—REFTON—HARMONY SCHOOL—SMITHVILLE—HICKORY SCHOOL.

3rd Division: STRASBURG—NEW PROVIDENCE—TRUCE.

b. Command post:

I Corps: LANCASTER.
1st Division: MILLERSVILLE.
2nd Division: HOLLINGER.
3rd Division: STRASBURG.

By command of Col. X,
Y,
Executive.

Distribution: omitted.

DISCUSSION OF THE SOLUTION

Paragraph 1.—The publication of the information of the situation in an Annex may be considered unique. My reason for it is, in my belief, that literary forms should be adapted to the circumstances—not the latter to the former. In comparison with the other combatant elements of the Corps, the deployment of the 105th Artillery is unique. Take the infantry. As we descend the hierachy of command we encounter units collected in zones of action of successively decreasing frontages. No such condition obtains for the antiaircraft artillery regiment. It is spread over the entire corps front. We know how difficult are communications within a division. There is no basis for the fond belief that the antiaircraft regiment can establish and maintain a complicated communications net over such a front and for such a depth in a moving situation. Interruptions, sometimes prolonged for hours, must be expected in communications to or from elements advancing with the divisions. Initiative in the lower echelons of the regiment must be relied upon. If sound action is to be expected, the lower commanders must be informed as to what it is all about. Therefore the volume of the information of the situation given in Annex No. 1, including the scheme of maneuver of the corps and the locations of elements to be protected. This necessary information is so voluminous that it would encumber too much the orders of the battalion and lower commanders. The device is therefore employed of putting this information in an annex. The preparation of this annex involves no tactical decision—only tacti-

cal appreciation. A staff officer can edit it and see it through the mimeograph while the field order is being prepared. A glance at the "Distribution" of Appendix No. 1, shows that there is a copy for each officer in the regiment.

Paragraph 2.—The mission assigned by the corps establishes the general line of deployment. This is followed out. In addition thereto the regimental commander orders a mobile, offensive form of action in protecting the troops in motion during the attack.

Paragraph 3a.—The batteries of the gun battalion are given general locations which will conform to the corps order. The positions selected are on high ground which will permit freedom in observation and pointing. The general locations should assure the following:

a. Fire support against enemy airplanes until our divisions have passed the first enemy organized position.

b. Avoidance of conflict with corps artillery positions and probable positions of divisional artillery and reserves, and appropriately distant therefrom for efficient fire action.

c. Driving off enemy airplanes attempting to bomb our troops. By their changes of position and utilization of concealment, the divisional elements should secure an appreciable degree of immunity against bombing. Also, these units can be protected closely by the machine guns of the antiaircraft artillery which will keep the bombers at appreciable altitudes. The corps artillery and the corps infantry reserves are the principal agencies of the corps commander for influencing the attack. The security of these elements should be assured. The corps artillery, particularly, moves with some deliberation. It must be expected that the enemy, by aerial observation, flash ranging, or sound ranging, will detect ultimately the positions of this artillery. A bombing attack, directed with definite precision against these objectives, or counter battery, can then be expected. In order that the corps artillery may occupy its initial emplacements as long as may be desirable for our purposes, and in order that its freedom from molestation may be protracted, enemy bombers, enemy air observers, enemy aerial photographers must be driven off or kept at such altitudes as to destroy their efficiency. Therefore the gun battalion is informed as to the choice of targets it should make in the event of a simultaneous, yet diverse, enemy aerial concentration.

d. Ready establishment and maintenance of signal communications.

e. Rapid forward displacement.

f. Supply and evacuation.

The observation of, and reporting, friendly and enemy aerial activity is an important duty of aircraft artillery. Ground observation of the air is in some important respects even superior to that of aerial observers. Besides that, it is a decided advantage to our air service if this observation can reduce the wear and tear on our airplanes and reduce the exhaustion of our pilots and observers which are occasioned by the maintenance of air patrols. While an enemy airplane operation may be completed *in this small area* before the antiaircraft artillery reports can be transmitted to our air service, yet such reports should provide important information from which our air service can deduce probable enemy aviation intentions. Moving, as they will, with some deliberation in protecting the corps artillery, the gun battalion should be able to provide the principal portion of this observation and should be able to maintain a good standard of communication for the rapid transmission of this combat intelligence.

Paragraph 3.—Three machine gun batteries are allocated at the rate of one per Infantry Division area and one to protect corps installations at Lancaster. The general reason for pushing three of them forward, is to have guns immediately present and available to destroy or nullify enemy airplanes which may attempt to observe, machine gun, or bomb our divisional troops from the lower altitudes. A question is whether those three batteries should be "attached" rather than that they should be placed "in support." There are good arguments for either organization. One of the principal reasons for attachment is that the rapidity of aircraft maneuvers will prevent much central fire control, and therefore a great decentralization of execution must be effected even down to platoons; and that, in view of the foregoing, the division commanders should control these batteries in the divisional areas. Where divisions are in detached positions, the force of that reason is increased. In the situation here presented, however, the divisions are concentrated in the attack, and the batteries will be close enough together to permit of an appreciable degree of coordination of observation, movement, and supply by the battalion commander. Also the corps infantry reserve and the corps artillery and balloons must be protected, and they are not under divisional command. Details of execution can be left largely to the machine gun battery commanders who should keep in touch with divisional commanders and respond to local calls for protection. Decentralization of execution can be secured in this organization also. Having the batteries "in support" in this situation is preferred for the following three reasons:

First: The air cannot be divided into "zones of action." The air in the general vicinity of the combat area must be viewed as a single area.

Second: Surveillance of the air should be maintained as much as possible by antiaircraft artillery personnel, and the combat intelligence so obtained should be transmitted promptly by the regimental headquarters to the corps air service headquarters. The antiaircraft artillery should therefore be kept under regimental command in this situation, both for necessary disposition of armament and observation, and for the maintenance of the organization of communications and of intelligence.

Third: The corps artillery, with attached balloons, and the corps infantry reserve should be protected under the control of the corps commander. The employment of some machine guns should be coordinated intimately with the guns for this purpose.

The mission to the machine gun battalion may be considered indefinite as to the extent of the division between the protection to be given the corps artillery and reserve, and that to be given to the Infantry Divisions. This may be a very important defect if the regimental commander stays in his command post back at Lancaster and if the machine gun battalion commander is without initiative; otherwise the defect should not be of any importance. The battalion commander, in his order, may prescribe the number and locations of platoons from each battery to protect the corps artillery and infantry reserve, and may prescribe what strength will advance in close support of the infantry. These actions he should follow up.

The regimental commander should inspect the dispositions and make desirable modifications.

The observation and reporting of aviation activity is a normal function of all antiaircraft troops. A question here arises as to the routing of the reports from the machine gunners. It would appear futile to tell the battalion to establish a complete separate net. Each division in its limited zone of action will have enough of a job to do that. It would be impossible for the machine gun battalion, with its limited means, to do it in a moving situation over a corps front. The maximum we can hope for it that one telephone line to the nearest gun battery can be extended and maintained as each machine gun battery headquarters moves forward.

A criticism may be aimed at the employment of only one machine gun battery to protect corps headquarters and installations at Lancaster. In reply, it is my belief that the fight will be won by the divisions and corps artillery and corps reserve, not by the installations in rear. Therefore the bulk of the antiaircraft artillery should be well forward to cover the decisive areas.

Another question is how the machine gun battalion commander is going to exercise command. I believe he can keep general track of the locations of each battery headquarters through the connec-

tion to the gun batteries. I visualize for him a roving commission, with special emphasis on the coordination of the action of his batteries along the boundaries of the 2nd Division.

Paragraph 3, x, (1).—This is merely in conformity with the corps order.

Paragraph 3, x, (2).—This may appear to be an indefinite arrangement. Under the limitations of the time and circumstances, I cannot see what more can be done. I believe that division commanders will give reasonable assistance in traffic control so as to assure the movements. It is to their own advantage. Futhermore, a study of the basic text shows that the machine gun companies have been previously attached to the divisions during the advance, and so an appreciable degree of mutual understanding will have been developed by this time.

Paragraph 3, x, (3).—The first sentence is in conformity with the corps orders. The last sentence gives the special mission of the antiaircraft artillery to promote, within its special power, the desire of the corps commander.

Paragraph 3, x, (4).—This is an appropriate, general directive.

Paragraph 3, x, (5).—This is to assure readiness for prompt movement.

Paragraph 4.—Pertinent provisions of the corps administrative orders are published in the annex. The selection has been made with a view to the wide frontage of the regiment and the decentralization of arrangements, necessitated for movements, both for the initial deployment and during the attack.

Paragraph 5a.—The purpose of the directive is to organize the laying of lines along prescribed routes. I visualize the following resulting net:

Lines will be run along the divisional axes of signal communication. The gun batteries will connect laterally to these. The lines will be extended forward to machine gun battery C Ps as they advance. When the gun batteries make a forward bound, they will connect laterally to these lines. As the battalion command posts make a bound forward, they will have a line or lines laid laterally connecting to the axial lines, and thereby to the gun batteries, and through the latter to the machine gun battery C Ps.

In Conclusion

Is the 105th Artillery on an offensive or defensive mission in this situation?

The question may be cleared up by an inspection of the action of the other troops on the field. There is only one kind of soldier present (excepting the small amount of cavalry) who can capture

and hold—he is the infantryman with a rifle and bayonet. There is your only Simon pure offensive element. What is the role, in the last analysis, of machine guns, tanks, artillery, air service? Their role is to defend the rifleman from interference during the advance. They defend by beating down enemy infantry fire, artillery fire, and other measures taken against our riflemen. The antiaircraft artillery beats down enemy aerial attempts against our riflemen and supporting arms.

Machine guns, tanks, air service, artillery, antiaircraft artillery, do their particular forms of damage with the same tools and with the same projectile effects on any sort of an occasion, be it so called "offensive" or "defensive" action. The essential distinction between their "offensive" and "defensive" action consists in whether the rifleman is attempting to "capture" or whether the rifleman is attempting to "hold."

Like the other troops, excepting the rifleman, the 105th Artillery is on the offensive in this situation simply because the riflemen are on the offensive.

It is my belief that the antiaircraft artillery is not exclusively a defensive arm any more or less than any other kind of artillery or supporting arm.

ROBERT E. LEE

"Read and re-read," said Napoleon, "the eighty-eight campaigns of Alexander, Hannibal, Caesar, Gustavus, Turenne, Eugene and Frederick. Take them as your models, for it is the only means of becoming a great leader and of mastering the secrets of the art of war." To that select band of great commanders the name of Robert E. Lee must be added. His exact precedence among them I will not attempt to determine, but that they have received him as a soldier worthy of their fellowship I do not doubt.
—*Major General Sir Frederick Maurice, in Robert E. Lee The Soldier.*

EDITORIALS

Military Reading

RECENTLY there appeared in one of the service publications a most interesting account of an investigation carried on by a regimental commander in which it developed that of his fifty-seven officers, only four were reading books, outside of those that pertained to their daily routine of work, that dealt with the military profession.

These figures do seem startling, but it is to be remembered that the time of the regimental officer is pretty fully occupied each day and that the very nature of his work requires that he do considerable reading in order properly to perform his duties and to hold his own in the competition for place—a competition that exists in the Army just as in any other walk of life. However, the officer who is satisfied just to hold his own is not apt particularly to distinguish himself during his military career. Personality, tact, judgment, initiative, self reliance are forces that wage a powerful influence in determining the degree of success an officer may attain; but another and most important factor is interest in one's profession and knowledge of the same. This interest and knowledge can be secured and maintained by an officer only by discussing his daily work with his brother officers, by imparting what he already knows to others, and by reading and studying.

The JOURNAL would like to suggest a course of reading of some of the text books used at the Coast Artillery School and General Service Schools, but after a long day of hard work it takes more determination than most of us have to read such books an hour or so each evening. Anyway, the time will come when every officer will gain a close acquaintance with the contents of these books, and thereafter, unless the lessons contained therein are to be forgotten, he will have to review these studies frequently, not necessarily by actually studying the same books, but by reading and digesting the activities and campaigns to which they apply.

It is held that the broad principles of military strategy have not changed in the past two thousand years. This probably is true, but

methods of waging combat change greatly with each succeeding war; therefore no matter how deeply one may investigate the campaigns and wars of Napoleon, conceded by practically every military writer to be the greatest captain of all times, he cannot from these studies alone form a conception of a future war. To form such a picture it is necessary also to study the campaigns of recent wars, particularly those of the World War, for it is proverbial that every war commences about where the last one left off. In addition to these a study of the biographies of military leaders is of interest and great value, for human nature changes but little and the problems confronting a leader a hundred or fifty years ago are similar to those facing leaders today, and the mental processes by which the problems are solved are very much the same.

With the foregoing as an argument the JOURNAL ventures to suggest that officers will find the following list of books interesting as well as profitable reading. Undoubtedly other and better books could be suggested, but these have withstood the test of time, or in the case of the more recent publications, have been most favorably reviewed. The reading of such books will of course suggest others to be read, the net result being that the reader's interest in his profession will be augmented, his knowledge of military affairs broadened, and his value as an army officer greatly increased.

Stonewall Jackson and the American Civil War. By Colonel G. F. R. Henderson. Published in 1903. This book is regarded, both in America and abroad as one of the finest military biographies ever written.

Turn of the Tide. By J. C. Wise. Published in 1920. An accurate account of the early American operations in France. Those described are the battles of Cantigny, Chateau-Thierry and the Second Battle of the Marne.

1914. By Field Marshal Sir John French. An account of the British Expeditionary Forces in France from the outbreak of the World War until May, 1915.

Principles of Strategy. By Colonel W. K. Naylor, U. S. Army. Published in 1921. Written by one of America's foremost instructors in strategy and military history. The book is replete with historical illustrations.

Napoleon, An Outline. By Brigadier General C. R. Ballard, British Army. Published in 1924. A concise appreciation of the military genius of Napoleon, as seen by a British writer. The book presents the history and strategy of Napoleon's campaigns in such a way as to be easily understood by the general reader.

Robert E. Lee the Soldier. By Sir Frederic Maurice. Published in 1924. An account of the Civil War campaigns of General Lee. Written by one of the world's foremost military writers.

The History of Tactics, by Captain A. F. Becke, British Army. Published in 1909. The author was for many years an instructor in British military schools. Discusses the history and development of tactics from 1740 to 1905. Replete with historical illustrations.

War According to Clauswitz. By Major General T. D. Pilcher, British Army. Published in 1918. A summary of Clauswitz's "On War," written in a manner easily understood.

Gallipoli Diary. By Sir Ian Hamilton. Published in 1920. An account of the landing on and occupation by the British forces of the Gallipoli Peninsula.

The Strategy of the Western Front. By Colonel H. H. Sargent. Published in 1920. An analysis of Germany's stategic operations and the plans of the Allies by which they were countered.

The defense of London. By Colonel A. Rawlinson. Published in 1923. A presentation of the tremendous problem that had to be met in building up the antiaircraft defense of London.

My Campaign in Mesopotamia. By Major General Sir Charles V. F. Townsbend. An account of the first British Expeditionary Force in Mesopotamia. Written by its Commanding General. It is unique among narratives in that the author gives a concrete statement of the basic principles of war and shows how he tried to apply them.

Battle studies. By General A. C. DuPicq. First published in 1870. This book stands alone as a study of the psychology of the soldier in battle. A military classic known to every French officer.

From Private to Field Marshal. By Field Marshal Sir William R. Robertson. Published in 1921. An account of the military career of the only man who ever climbed from the very bottom to the highest grade in the British Army. Written by himself. In the World War General Robertson was Quartermaster General, and later Chief of Staff of the British Army in Belgium; Chief of the Imperial General Staff; and Commander-in-Chief of the forces in Great Britain.

A New Editor

Major Robert Arthur, C. A. C., has been detailed Editor of the COAST ARTILLERY JOURNAL and is to assume his duties prior to the appearance of the September number. Everyone acquainted with Major Arthur will realize that the JOURNAL is being entrusted to a very able officer. He is a graduate of the United States Military Academy, class of 1907; a distinguished graduate of the Coast Artillery School, class of 1912; a graduate of the Advanced Course, Coast Artillery School, class of 1924; and a distinguished graduate of The Command and General Staff School at Fort Leavenworth, class of 1925. He has been awarded the Distinguished Service Medal for exceptionally meritorious and distinguished services rendered in France during the World War. The War Department order conferring the Medal on him states in part: "He commanded the 121st Field Artillery during the Aisne-Marne, Oise-Aisne, and Meuse-Argonne offensives with distinction. In addition he served as chief of heavy artillery of the 57th Field Artillery Brigade in those offensives. His high professional skill, sound judgment, leadership, and devotion to duty were material factors in the successful operations of the artillery forces with which he served." Not only do his educa-

tional qualifications fit him for his new detail but in addition he is recognized as an artilleryman of unusual merit. His writings on artillery subjects have appeared frequently in the pages of the JOURNAL, have always been based upon sound premises, and have often been used as lesson assignments by the Coast Artillery School. It is certain that the JOURNAL will be of unusual interest and value during the regime of Major Arthur.

Spotting

A bulletin issued April 6, 1925, from the Office of the Chief of Coast Artillery, states: "It is essential that spotting sections be so thoroughly trained that battery commanders can rely upon the data furnished them and make the adjustment corrections without hesitation, as soon as the spotting results are received." The question of spotting is one with which every battery commander is intimately concerned. He realizes that a satisfactory practice cannot be carried out without accurate and rapid spotting data. No standard spotting system has yet been adopted, and battery commanders have therefore improvised methods for determining the location of the fall of their shots. This has resulted in a great deal of thought being given to the principles of spotting, and to the mechanical devices involved. A universal spotting system for the Coast Artillery Corps will some day be accepted as standard but it is necessary meanwhile to proceed cautiously in order that such a system when adopted may prove satisfactory for many years. It is believed Lieutenant C. E. Brand, C. A. C. has expressed some very sound thoughts on spotting in an article that appears in the Professional Notes Department of this issue of the JOURNAL. It is invited to the attention of anyone seeking information upon this subject.

Teamwork in National Defense

There is a striking similarity in the relations that should exist for national defense between our harbor defenses and the navy, and between antiaircraft and the air service. Suitable defenses for our harbors will permit our fleet to exercise its proper mission—that of seeking out the enemy fleet and destroying it, or of keeping the ocean lanes open for our commerce. Without harbor defenses there would be an irresistible demand by our coast cities that a suitable number of warships be maintained in each of these harbors, in order to guard them from enemy raids. Such a disposition of our fleet would be disastrous to the proper functioning of the navy.

Similarly, if entire dependence were placed upon our Air Service to protect vulnerable points such as shipyards, powder works,

petroleum reserves, concentration camps, railway terminals, cities, and important bridges, the Air Service would be so split up and tied down that its greatest asset, mobility, would be largely neutralized. While antiaircraft artillery has a well recognized and indispensable mission as a component of corps and larger units in the field, it has just as important a mission in the defense of such vital localities. A few guns placed about each of these will furnish reasonable security from air attack, and will permit our planes to be concentrated at the larger fields and available in quantity for instant service. Both antiaircraft artillery and the air service are essential to the nation's scheme of defense, but there is a well marked line between the missions of the two.

The Lessons of 1918

[*Reprinted from the* CHICAGO TRIBUNE.]

General Bullard's memoirs of the late war continue to furnish food for the serious thought of the American people and especially for those in authority.

For example, we suggest that there be set off against the perpetual propaganda of the opponents of preparedness his remarks on the condition of our army in the crucial month of the great German drive to break apart the British-French line. That was in March, 1918, virtually one year from our declaration of war and the first mobilization of our military forces.

This year had been spent in strenuous preparation, and yet not even one division was fit to take a place in battle without the aid of French officers, French organization, and French equipment and supply. Gen. Bullard is by no means inclined to underestimate the merits of his famous division or their progress in preparation, but any intelligent reader must be impressed with the significance of his frequent references to the overseeing, tutelage, and aid of the French.

His officers and soldiers of the line could fill in the story with staggering effect. General Bullard gives only the larger outlines and makes the best of what was a serious situation. We should be the better for even more candor, for the whole picture, in vivid detail, of our army's unpreparedness.

No one who realizes the complexity and scale of modern war will harshly blame our men for their mistakes or limitations. They were men, brave and devoted men, not gods or demigods, and they paid a ghastly price. But the real fault lies with their nation and its governments, year in and year out, who refused to face facts and make intelligent preparation against eventualities.

And now, despite the rough lessons of actual experience, we are back again in our pleasant illusions. The pacificist and the shortsighted devotee of mistaken economies are shaping our policies precisely as before the sanguinary days of 1918. Then, fortunately for our honor and our cause, we had the seasoned armies of our allies to hold back the enemy and bear the brunt of the onset. That is not likely to happen again. Yet we manufacture patent formulae for eternal peace and drift toward disaster.

It behooves all officers of whatever grade to fit themselves, by unceasing thought and study, for the exercise of command. No one knows how soon his services may be urgently required in defense of the country. Much can be learned from an intelligent study of military history, and no one can be too well prepared for the great responsibilities of war. It is well to remember, in the course of our work of preparation for to-morrow, that principles do not change, though the method of their application is ever changing. No matter how much the machinery of war may be developed in the final analysis, it is the man we must understand. Man, with all his strength and all his weaknesses, always has been and always will be the basic element, and it is the knowledge of his psychology that we must master when we consider how his best efforts may be developed in war.—*Major General Hunter Liggett in "Commanding an American Army."*

PROFESSIONAL NOTES

Spotting

By 1st Lieut. C. E. Brand, C. A. C.

The Naval War College considers fire at large ships at beyond 21,000 yards *ineffective,* less than two per cent hits being expected. At 25,000 yards only three per cent hits are expected. It appears highly probable, therefore, in spite of the somewhat greater accuracy of the fire of seacoast guns, that a battery firing at beyond 25,000 yards range would expend its entire battle allowance of ammunition and its accuracy life without doing any vital damage to its target ship. This would indicate that effective firing at battleships and therefore effective position finding and spotting in seacoast actions must be done within 25,000 yards range. It is not that our guns are useless beyond this range. It has been demonstrated that a large city may be hit by cannon fire at a range of 76 miles—but not a moving battleship. The idea is visionary at least.* And even if such fire at naval targets (with destructive effect) were possible the fact remains that our present position finding service and most of our guns do not range beyond 25,000 yards or therebout, and our present need is for a spotting service to match.

Upon the basis of the above and of certain other more or less obvious necessities in spotting, we may now formulate some basic specifications for a satisfactory spotting service:

(1) It must cover the area covered by the position finding service of the battery.

(2) It must be as dependable as the position finding service and must function with it.

(3) It must be quick in operation and give accurate results (at least within a probable error—the more accurate the better).

(4) It must not prevent the effective functioning of the position finding service of any battery.

(5) It must be able to single out the particular impacts of shots of a particular battery, disregarding all others.

(6) If designed for more than one battery it must be able to spot many shots at near the same time.

(7) It should be able to furnish deviations from the point on which the gun was laid (the setforward point) rather than from the actual position of the target at the instant of impact.

(8) It should be a permanent standard installation. In view of its great importance in adding to the effectiveness of the millions already spent on armament, an outlay of a few thousands for satisfactory instruments which may be

* It has been gratifying to note since this was written that the War Department has in Provisional TR 435-20 stated this matter plainly, pointing out that unless naval forces were conducting a long range bombardment of a city, naval facilities, etc., the batteries would *not open fire* beyond 20,000 yards except to establish the range, which corresponds closely with naval doctrine. To quote from the above TR, "when the enemy has entered the 4th sub-area (15,000-20,000 yards) the time has arrived for the defenses to engage capital ships seriously." Fire beyond that range is a special case of more moral than material importance. It is not, however, entirely negligible.

necessary is not objectionable. For the same reason the technical staff of the Ordnance Department should perfect the design of and manufacture any such instruments with any necessary materials which may be bought on the open market at reasonable prices or obtained otherwise practicably—*not* the company mechanic with odd pieces of brass and scrap lumber.

Specifications (1) and (2) suggest strongly that the spotting system should be bound up with the position finding service. These important, *necessary* requirements are thereby assured; however there must be no conflict with specification (4). Specifications (1) and (2) also suggest, and (5), (6), and (7) practically require, that the spotting shall be done individually by each battery and not by central spotting agencies for groups of batteries. Coast Artillery Memorandum No. 1 in fact now places the responsibility for spotting with the individual battery by not allowing time out for slow spotting in the rating of the battery. Under this hypothesis specification (6) would be no longer necessary. However the advantages of centralized spotting merit further consideration which will be taken up later.

Specification (5) may be accomplished through utilization of the time of flight and the scant possibility of absolute simultaniety of impacts of shots from unrelated batteries. This is done successfully in the navy by use of a clock which is set at the time of flight, is started like a stop watch at the firing of the guns, and rings three second-bells, (just as our observers use the time interval bells) to indicate the instant of impact, which occurs on the third bell. The instrument for this purpose has therefore already been devised. For coast artillery purposes it should be graduated so as to be set in range (instead of time of flight) for any particular battery. By means of this instrument spots from air observers may be identified in the same manner, the air observer calling "splash" or making a buzzer signal at the instant he observes the splash and adding the spot immediately thereafter. In a general action these signals (with accompanying spots) would follow each other with such rapidity and irregularity that it would probably be necessary to utilize several observers operating on the same wave length. However each particular battery should be able to distinguish its own data by the signal immediately following the third stroke of its splash clock. It will be necessary in such a case, also, to refer all spots to some normal GT line which may require a conversion of coordinates for some batteries in case the armament is dispersed laterally an appreciable amount as compared with the range.

If, as suggested above, the observing stations of the battery are to be the spotting stations it is obvious that some form of bi-lateral spotting must be used. Moreover it is sound that both of these services should use the same stations and cables since one service is useless without the other, and therefore by separating them the chance of the battery being put out of action by the disability of one of them is doubled. If it may be argued against such combination that there exists some special vantage point for spotting in some particular case, it is also a fact and to the same extent that it is a special vantage point for position finding. All arguments of this nature must obviously apply equally.

Such a vantage point does in fact exist for lateral spotting in that all or practically all coast artillery batteries have one observing station at or near the battery. Lateral angular deviations from the target may therefore be directly observed and measured without difficulty and under satisfactory "service" conditions from this station. Even though such station be several hundred yards from the directing point of the battery the measured angular deviation of the splash as viewed from it is sensibly the same as the lateral deviation from the gun-target line. This is not true of the corresponding azimuths. Such deviations may also be measured satisfactorily from the setforward point with the present equipment and without interference with the position finding service. It in fact has been done with entire satisfaction. The spotting problem which remains unsolved is therefore one of longitudinal deviations. And in this problem advantage may and should be taken of the fact mentioned above that one observing station may

be located at or near the battery. The exceptional case where this is not true, however, should not be ignored in either lateral or longitudinal spotting.

Longitudinal deviations may be measured from bi-lateral observations in general in two ways: (1) by measuring the range to the target (or setforward point) and the range to the splash or impact at the instant of impact and taking the difference; (2) by measuring directly the longitudinal distance between the target (or setforward point) and the point of impact. It is obvious that since the first method involves more or less independent measurements of large quantities, the difference between these measurements is much more susceptible of error, and susceptible of larger errors, than if the difference were measured between two visible points directly as such. Without further consideration, therefore, other factors being equal or nearly so, we should adopt the second method. In other words the observed quantities from each station should be not azimuths of target and of impact, but the *angular displacement of impact with regard to target.* This condition, however, presents itself only when the deviation is to be measured from a material target. And this, we have seen, is of no direct utility as a basis of fire adjustment corrections unless the position of the target at the instant of impact is known to coincide very approximately with the setforward point selected by the plotter, and this cannot be expected except in the conventional target practice. And when the deviation is to be measured from the setforward point, itself, as must be done in the usual case, there is obviously involved in determining the azimuth of the setforward point from the spotting station, and setting it on the spotting observer's instrument the inverted process of an independent plot (the unavoidable errors of which it was sought to avoid be basing the measurement upon an observed *deviation*) and all the errors of separate measurement are reintroduced. In order that this may be clearly seen it is necessary to anticipate certain points which are to be discussed later. In particular, suppose that the telescopes of the spotting observers are to be set upon the setforward point by bringing up the B′ and B″ arms of the plotting board upon the targ before it has been removed from the setforward point and transmitting the azimuths read to the respective spotting observers at these stations. Consider the spotting instruments thus set in azimuth and the arms and targ still in place on the plotting board. Now clearly the spotting instruments are set upon the real setforward point by exactly the same error by which the plotted point would be in error were the process considered reversed. The plotted position of the splash which follows must be identical whether the reading by which it is determined is taken from the azimuth scale or a deviation scale. As for accuracy there is therefore no choice, when spotting is done on the setforward point, whether the two points are each determined independently and their difference then measured, or whether one point is plotted with respect to the other by means of a measured angular deviation. Tentative provision should therefore be made for both methods of determination until some other consideration in the completed system of spotting may place one method or the other at a comparative advantage.

The problem has now narrowed itself down within workable limits. It may be stated in two parts: (1) by use of the present observing stations (positions) to measure accurately and rapidly either (a) azimuths of impacts, or (b) angular displacements of impacts from target; (2) from these measurements to determine accurately and rapidly longitudinal linear displacements of impacts from target along the gun-target line. To take up these parts of the problem in the order named, it appears at once that either aspect of the first may be readily accomplished by the use of any azimuth instrument with a splash scale such as, for example, those with which our present B. C. telescopes (Model 1910) are equipped. A more satisfactory form is the glass cell carrying both cross wire and splash scale marked upon it, the latter on its lateral diameter (such as B. C. telescope Model 1918, except that graduations should be in degrees and hundredths instead of in mils). Better than either of these is a French observation telescope of which there are a few in our service equipped with such a splash scale, though unfortunately without a pointer, and with 15,- 23,- and 30-power eye pieces so

mounted that either may be turned into position for use in an instant. The particular superiority of this instrument for the present purpose lies in the fact that it is equipped with two independent traversing knobs and scales. One scale is normally set at zero. This scale is graduated and numbered in both directions from zero: right, red; left, black; and is provided with a subscale to give readings of the finest accuracy as well as instantaneously. The second scale is the ordinary azimuth scale, which is oriented so that the instrument reads correct azimuths with the first scale set at zero as indicated. The target is followed in the ordinary manner by traversing the instrument on the azimuth scale (or the azimuth of the setforward point is set on this scale when spotting is done on the setforward point). At the instant of impact this traversing stops, and the cross wire is turned instantly upon the splash by means of the first knob. The observer calls *right* or *left* according as the splash is in the *red* or *black* part of his scale—the actual right or left—and glances at his scale to add at once the exact amount in hundredths, which should be done within two seconds after the splash. There is no time lost in estimating the nearest graduation, which makes for accuracy and positive certainty as well as speed. It must be added that these instruments are at present graduated in mils. This should be changed to degrees and hundredths, as all the standard coast artillery instruments are graduated, and other slight modifications made to make what has been said above strictly true. The addition of a splash scale pointer would also increase its usefulness, since this would permit small deviations being read directly from the splash scale. It should moveover be mounted upon a pedestal for complete stability, which it lacks upon the tripod mount. This instrument with the proposed modifications completely and thoroughly solves the first part of the spotting problem, namely the effecting of rapid and accurate measurements of azimuths or angular deviations as viewed from the observing stations. Any extra telescope with a splash scale, even the observer D. P. F., would be a possible alternate or emergency instrument for this purpose, provided that such use of the D. P. F. did not interfere with its primary function.

The remaining part of the spotting problem is now restated (2) given the accurate angular deviations of the splash from a target point of known range and azimuth from the battery, measured from stations of known positions: to determine accurately and rapidly the longitudinal deviation of the splash from the target point with regard to the battery. Since the plotting board is our most familiar instrument for solving such problems it at once suggests itself. With the arms set accurately on the setforward point their intersection is the point from which measurement should be made. By moving each of them right or left the amount of the deviations called off by the spotting observers the point of impact is determined and may be accurately targed; or, as noted above, the point of impact may be located with equal accuracy by plotting it directly by its azimuth from the two stations. The longitudinal distance between these two points measured directly to the scale of the board is the deviation required. Adaptations of this method have frequently been attempted without particularly good results either as to rapidity or accuracy. The practical difficulties to be encountered and effective means of overcoming them are as follows:

(1) If spotting is to be done with reference to the target, it is necessary that the target be plotted simultaneously with the splash. This is obviously impossible. If one is plotted by deviations immediately after the other, with present equipment, the time consumed and errors introduced are prohibitive. Such spotting as is contemplated here must therefore be done on the setforward point, which is indeed the desired end. But this necessitates a determination of azimuths of the setforward point from both spotting observers and its transmission to them in order that their instruments may be properly set in case the impact is to be plotted from a measured deviation. And these azimuths are not ordinarly determined in drill. This could easily be done, however, without inconveniencing the position finding service in any way, by the use of a duplicate plotting board. Such a duplicate board in fact exists in many batteries, and its existence is

assumed as a necessity in the following discussion, whether the impacts are plotted by deviations or by azimuths. The gun-armsetter of the duplicate plotting board, or spotting board, is connected by telephone on the regular B′ reader-armsetter line so that he hears the true azimuth of the setforward point from the battery called off and sets it on his own arm. Similarly the spotter is connected by telephone with the Pratt Range Board operator or some corresponding number who calls off the true range of the setforward point. The spotter upon hearing this range targs the setforward point, and the gun arm is cleared. The setforward point is now located on the second plotting board, or spotting board, and if its azimuths from the B′ and B″ stations are desired the B′ and B″ arms are

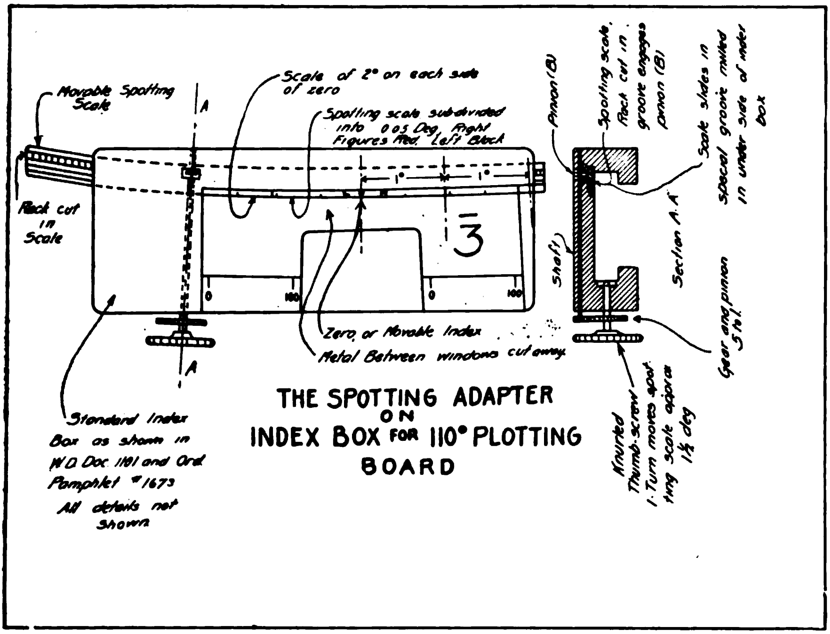

FIG. 1

AUTHOR'S NOTE: *This modification of the index box on the 110° board (as well as the apparatus shown in the other figures) was designed by an ordnance officer skilled in such work. And its utter simplicity and effectiveness strikingly illustrates the point made elsewhere in this article that designing is not the work of a layman, but of an expert. The operation is as follows: after the arm has been set up on the targ, as described in the text, the movable index (i. e. the index of the movable spotting scale) is set by means of the knurled thumb screw on the nearest even degree of the azimuth circle. Thereafter when the "spot" is received, it is set so much right or left from this even degree directly on the spotting scale by moving the arm right or left the required amount.*

then brought up against the targ and the azimuths read off to the spotting observers who are connected by telephone with the B′ and B″ armsetters. The angular deviations of the splash from the setforward point, or simply the azimuths of the splash, are called back by the spotting observers over the same lines, and the measured longitudinal deviation called off by the spotter to the Pratt Range Board operator or corresponding number who applies the necessary fire adjustment correction.

(2) The scales and means of setting the arms of the plotting board are not adaptible to accurate and rapid "right" and "left" settings of odd amounts from given odd azimuths (in case spotting is to be done by deviations). This cannot be remedied without modifying the sub-scale on the arm by adding a movable part to it. There is no difficulty in making this change, however, and the movable

index would have considerable utility in position finding as well as in spotting if employed on the gun arm for setting azimuth corrections. Improvised devices for this purpose have in fact been proposed. A very simple modification of the index box of the 110° board is shown in Fig. 1.* This would be still more simply accomplished on the gun arm or on the arms of the Cloke board. By means of this simple modification it will be seen that a scale of the index box may be set at zero regardless of the position of the arm, so that any position may be taken as a reference point and any desired setting made right or left from it, within limits of two degrees.

It might appear that since the point of impact may be determined with the same degree of accuracy by simply plotting it from its observed azimuth as by plotting it from observed deviations, there would be no occasion for transmitting the azimuths of the setforward point to the spotting observers. However, at this point there occur several considerations which argue in favor of spotting from deviations instead of from azimuths. First, in a general engagement it will as a rule be far simpler to give the spotting observers certain azimuths and direct them to read a splash occuring in their fields at a given instant than to attempt to keep them (in addition to the regular observers) constantly on target. Second, the splash will as a rule be nearer the setforward point than to the target, and therefore more certainly in the field of the observer if set of the setforward point than if tracking the target. This is particularly true in cases where spotting on the setforward point is of most value. Third, deviations can be much more quickly read than azimuths. In fact the spotting observer would probably require a reader if azimuths were required, just as in the case of the regular observers. The azimuths of the setforward point should therefore in all cases be transmitted to the spotting observers and set upon their instruments. Their observations may then be made either as azimuths or deviations, and deviations appear best with the modified index to permit their setting. It should be noted also that the entire process of transferring the setforward point to the spotting board, reading the azimuths on the B′ and B″ arms, transmitting them to the spotting observers, and setting them upon their instruments, is done with great deliberation, the time being ample, and should accordingly be accomplished with a high degree of accuracy.

(3) The longitudinal deviation of the plotted splash, which is coupled with a certain amount of lateral deviation, cannot be readily or accurately read from a random section of any of the arms or scales of the plotting board. A separate and special scale must be used for this purpose. On account of the lateral deviations this scale must take the form of a rectangularly ruled grid, or at least a grid with one central line-of-sight ruling and parallel rulings perpendicular to the line of sight to read hundreds of yards and subdivided by finer lines to read twenties of longitudinal deviations. This grid should be ruled upon a semi-transparent substance such as xylonite, and the "over" and "short" sides of the median line should be of different colors. There should be a sharp pin-point under the center of the grid to place in the targed setforward point and another very short pin-point on the end of the line of sight toward the battery to hold it fast in direction when oriented. The grid must be thin and its edges beveled so that the arms of the board may pass over it without catching.†

The entire spotting proceedure is then as follows: The gun-armsetter sets the gun arm at the azimuth of the setforward point as described above. The spotter makes a short pencil line of direction along the gun arm and targs the setforward point at the proper range. The gun arm is cleared and the spotting grid carefully placed in position. The targ is now placed on the setforward point as marked by a sharp prick point hole in the exact center of the grid and the B′ and B″ arms brought up carefully against it. There will be small danger of moving the targ by bringing the arms up against it with its point set in the

* See accompanying note for explanation.

† See Fig. 2 and Note. There are certain minor variations from the above description which may be noted.

hard substance of the grid. The azimuths are read off to the spotting observers as described above. The splash clock, per specification (5), properly set in range, is started by the gun-armsetter with the firing of the gun, and the armsetters call "one, two, splash!" to the observers with the bells. The angular deviations (or azimuths) are called off by the observers and set on the arms as described above and the resultant point of impact targed. Immediately when the armsetters have called "set" the spotter calls "over" or "short," as the case may be, which is the armsetters' signal to clear, and adds at once the exact amount, interpolating to the nearest ten yards on his grid. Targing the point and reading the deviation could not consume more than two seconds. It is believed that by this system of spotting the deviation report should be in the hands of the man who applies the correction within an average time of five seconds after the splash. In cases where the B′ station may be made the directing point

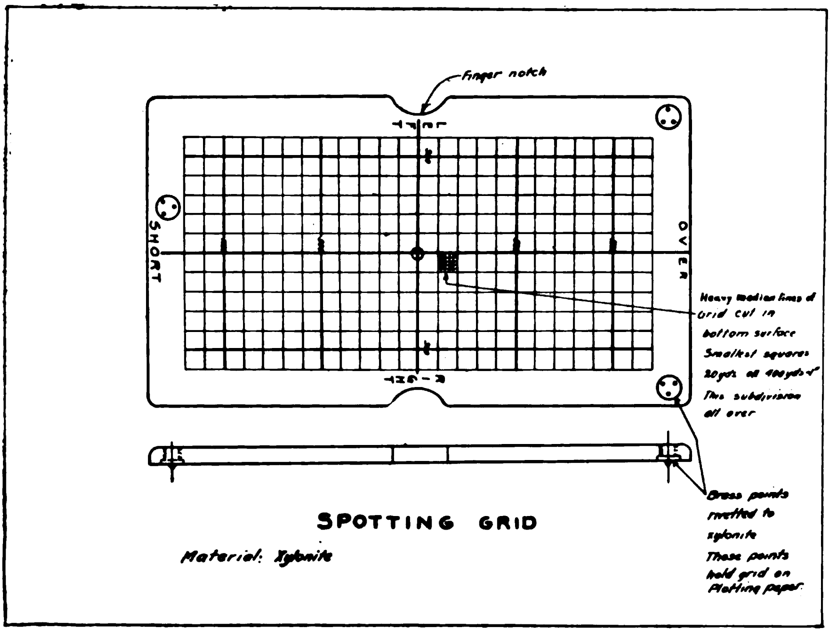

Fig. 2

Author's Note: *This spotted grid is designed to be set on the setforward point and the line of orientation by fine lines on its under surface. By this means perfect coincidence is assured, the spotter having ample time to check his setting. The grid graduations proper, upon which the deviations are read, are cut in the top surface of the grid to facilitate reading. Pressure upon the grid after it is set imbeds its three points into the board, insuring its immobility. This construction is slightly different from that suggested in the text.*

of the battery, which is possible in nearly all gun batteries, the entire system, as well as the position finding system, is greatly simplified by the elimination of the B′ arm. It may be added that approximate spotting on the target may be done by setting the grid at the approximate target position—the nearest even degree is fairly accurate—and measuring the angular deviations from the target as described under the discussion of the observation telescope above. This is in every way less desirable than accurate spotting on the setforward point and will not commend itself to persons well grounded in the principles of position finding and fire adjustment.

This system of spotting is particularly applicable to batteries already provided with two plotting boards since in this case the only alterations necessary

are the addition of movable indices on the arms,* which increase the usefulness of the boards for plotting as well as for spotting in case it should be desired at any time to interchange the two or use an alternate system for either. The grids are very simple, but should be made with great care to insure accuracy. In quantity production the cost of each should be very small. Observation telescopes for the spotting observers, and their telephone lines, are essential. The telescope described above is by far better than the ordinary azimuth instrument, if deviations are to be measured, though the latter might be used successfully at the B′ station, especially if it were also the B. C. station. One "splash clock." as it has been called, should be provided for each spotting section. No wiring for it is necessary. To operate this complete spotting apparatus requires two observers, one spotter, and three (or two) armsetters. The duplicate plotting board with the usual necessary telephone connections is of course essential. The cost of the entire installation including telescopes, movable indices, spotting grid, and splash clock, but assuming the duplicate plotting board and spare lines in important cables for the spotting observers, should be well within the value of one or two rounds of target practice ammunition, depending upon the gun served.

The spotting system described above, as has been noted, is not universally applicable for the reason that all batteries do not have two plotting rooms. Even for batteries which do have two plotting rooms an alternate set of plotting and spotting equipment will materially increase the fighting efficiency of the battery. The second plotting board, equipped as described above, will serve as both if an additional spotting device is provided. In constructing an entirely separate spotting device it may or may not be most effective and convenient to follow the pattern of the plotting board. Obviously the course of the target and the broad area of the board have no significance in spotting as they do in plotting. In fact all that is used of the board in spotting is the intersection of the arms and the area usually within less than a thousand yards radius of this intersection. If a device can be made of no greater area than this it will have obvious advantages of great importance, particularly as to room for its installation in batteries already constructed and, of equal importance, its portability in case of mobile units in coast and field operations. Moreover it would be possible in such a case to use a much larger scale for the device which would make for greater simplicity as well as for finer accuracy. It therefore becomes expedient to consider the possibility of constructing such a device.

Assuming a mechanical solution similar to that of the plotting board it is obvious that the center of the area upon which the solution is to be performed should be the point upon which the fire is to be adjusted if this area is to be a minimum. It is equally clear that the minimum area which could be used would be the rectangle or "oval" of dispersion of the gun plus a liberal allowance for initial correction which should not exceed a thousand yards. Assuming a maximum accidental error of the piece of 1000 yards, the area of our device should therefore be a circle of 2000 yards radius. The actual size would of course depend on the scale used, but should not be more than 20 inches in radius (at 100 yards per inch), which is a generously large board. Assuming a maximum deviation of 1200 yards (initial plus accidental) and a scale of 200 yards per inch the radius of the board is reduced to six inches, a conservatively small size. An effective board might be still smaller, but these appear practical limits.

The problem to be solved by this device is essentially the problem solved by the plotting board. The lines of direction from the observing stations to the point upon which the gun is laid must be represented by lines intersecting at the center of the board. The lines B′-splash and B″-splash must be represented by other lines intersecting at a second point. The component of the deviation of this second point from the first parallel to the line of fire must be measured. Since the first point is in fact the center of the board, the lines which determine

* These are not necessary if spots are to be made from azimuths of splash.

it have no direct utility and may be disregarded. However, the second point, which it is the function of the board to locate, is determined by the B′-splash and B″-splash lines, and these must therefore be capable of instant and accurate determination upon receipt of the angular deviations reports. It does not appear practicable to locate this point on such a board from azimuths of the splash. Since, however, it has been shown that the spotting observers should be supplied with the azimuths of the setforward point in any event for purposes of identification and to insure the splash being in the field of view, there is involved no greater difficulty of any kind in plotting the splash by its deviations. This may be done in general in two ways. The first is by actually representing to scale, off the board, the B′, B″, and battery positions, pivoting long arms at these

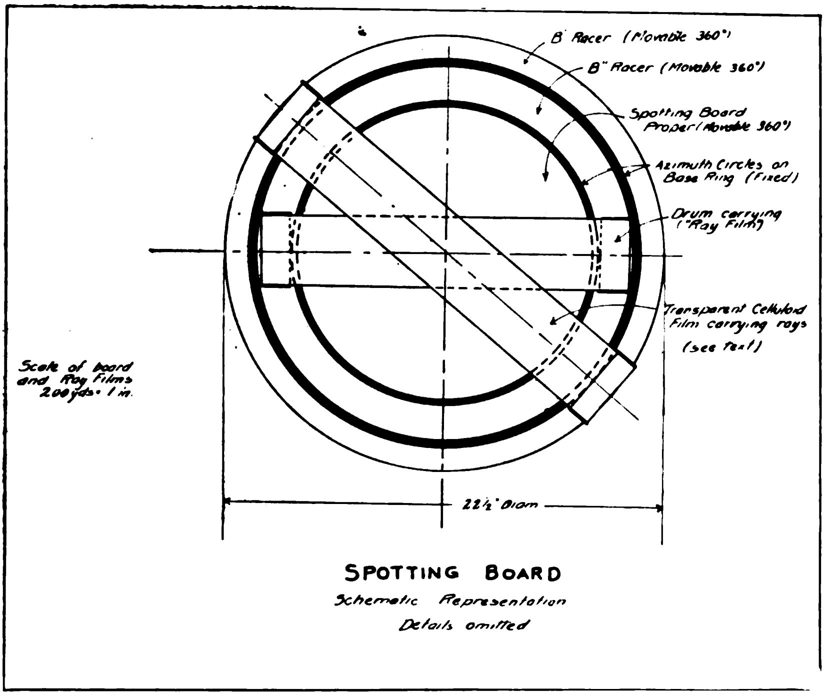

Fig. 3

positions, and keeping the whole system oriented to the principle of the Cloke plotting board. A device of this sort was proposed and described by Major Q. Gray in the Coast Artillery Journal a few years ago.

The second method of effecting the solution is by limiting the device strictly to the board used, determining the data for the necessary orientation of the lines of observation from other sources. This orientation consists in causing the lines B′-target and B″-target to intersect at the proper angle at the center of the board and in determining the segments of the lines B′-splash and B″-splash which intersect on the board. The first part of this orientation, namely causing the B′-target and B″-target lines to intersect at the proper angle, is easily accomplished by use of the azimuths of the target from the stations. For obviously the required angle of intersection at the target is the difference between the azimuths of B′ and B″ from the target, and these in turn are the back-

azimuths of the target from the stations. Since only the angle of intersection is required it will be more convenient to set the azimuths direct instead of the back-azimuths, the intersection being identical. Therefore if the circumference of the spotting board is graduated in degrees and the B′-target and B″-target lines set in azimuth on it from the center of the board the proper intersection of these lines is thereby affected. The determination on the board of the line segments representing the lines of observation to the splash and whose intersection is the point whose deviation from the center of the board is to be measured is not so simple. Since the distance of the line segment B′-splash from the line segment B′-target is at any point a function of the range of the target from B′ as well as of the angular deviation of the splash from the target, the ranges B′-target and B″-target as well as the azimuths must necessarily be used in this determination. Inasmuch as this particular requirement of the spotting board furnishes a crucial test of the proposed system of spotting which employs it, it may be well to pause here to completely visualize the problem to be solved.

If from a point there is drawn a flat pencil of rays at .05 degrees apart covering, for instance, two degrees on either side of a median line and extending indefinitely, it may afterwards be graduated to any linear scale desired. The farther the rays are extended the more they diverge. However the *angular* distance between two adjacent rays is always .05 degrees. Since the tangent of one degree is .01746, or in other words a degree subtends 1¾ inches at 100 inches, such a pencil would be 3½ inches wide at 50 inches and seven inches wide at 100 inches. The .05° rays at these distances would be about 1/23 inch and 1/12 inch apart respectively. This segment of the pencil from 50 to 100 inches might conveniently represent the ranges 10,000-20,000 yards, the usual spotting ranges at the scale of 200 yards to the inch. The same segment might be made to represent the ranges 5,000-10,000 yards at 100 yards to the inch by setting half the range on each according to the first graduations, and so on indefinitely for still smaller or greater ranges. We may think now of the B′-target and B″-target lines as the median lines of such pencils. Upon the spotting board, then, proper segments of these two pencils, according to the range on each, are set with their median lines to intersect at the proper angle, as described above. The problem is now to pick out the particular ray of each pencil which contains the splash, to note the intersection of these two rays, and to measure the deviation of the point so determined from the center of the board according to the scale used. This is the *picture* of the problem. It may or may not be expedient to actually draw the pencil segments about the median OT lines. But they must in any event be conceived there, and the proper rays whose intersection is the splash must be actually and accurately determined.

As was noted above, any ray segment in the vicinity of the target is determined by two known conditions (expressed in mathematical language), namely (1) the angular deviation of the splash from the target (the required ray segment containing the splash), and (2) the range to the target along the OT line. This implies that the perpendicular distance of the ray segment from the target point is determined as the product of the range (along the OT line) by the tangent of the angular deviation, and that its slope or inclination to the median line is determined directly by the angular deviation which is in fact the angle of inclination of the ray segment to the median line of direction whatever may be its distance from this line, i. e. independent of the range. The segment is therefore determined by (1) locating on the perpendicular to the OT line through the target point a point the proper lateral distance from the target point, and (2) setting the ray segment through this point at the given inclination to the median OT line. The second operation means setting a second point on the ray segment upon a given scale graduation—that is, upon a second given point. Since the ray is therefore necessarily determined by two points it is practically expedient to determine points on the ray at successive ranges—say at 2000 yards apart—as the first point was determined. A straight edge set upon two of these points will then determine the required ray segment. The ray segment contain-

ing the splash from the second pencil is determined in the same manner, and the targed intersection of the straight edges is the point of splash whose deviation from the center of the board may be readily called off at a glance. This has been done practically in the Cole spotting board, which is perhaps the most succesful spotting device so far constructed. General familiarity with this device is assumed, since it has been described in the COAST ARTILLERY JOURNAL, and it will therefore not be discussed in detail. Attention is invited, however, to the facts that (1) the instrument is crude, in the mechanical suspension of its moving parts, and, in particular, in that the end points of the rays, as described above,

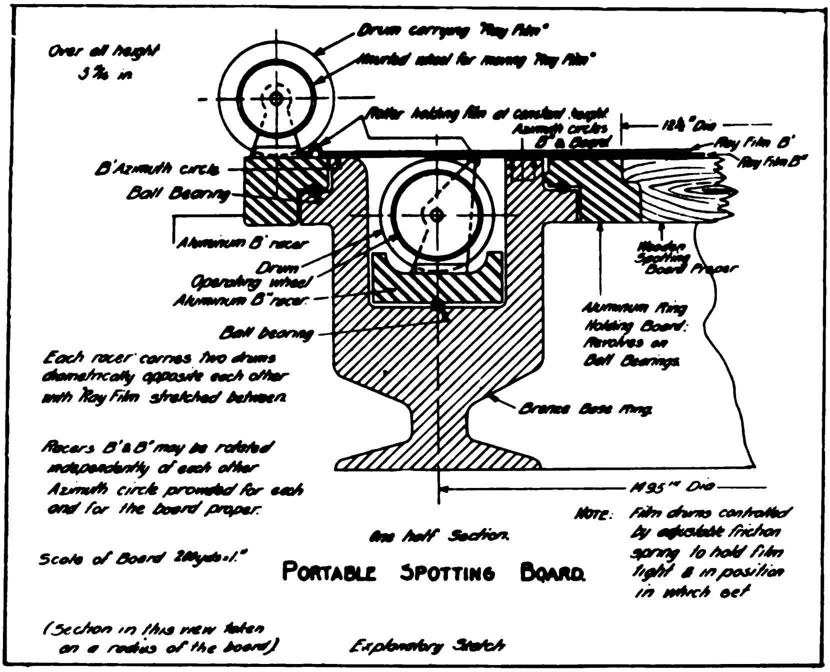

FIG. 4

AUTHOR'S NOTE: *These diagrams are purposely made to explain construction and operation rather than to serve as a machinist's "working diagrams," though they are drawn to scale (note dimensions), and it would be a simple matter to dimension them in detail and further detail component parts, specify materials, machining operations, etc. It will be noted that the large racers used in this construction make for a particularly high degree of accuracy as well as for great stability and durability of construction. Judging from the size of this diagram it is evident that the scale of the board might be doubled, if desired, and its other dimensions increased accordingly, without materially affecting its portability.*

are contained on movable cylindrical paper scales, and (2) data must be set on it by four separate individuals all of whom must call "set" before the spotter can targ his point. The first defect, that of crudeness, may be minimized by careful construction and by using a large scale. A part of it, however, is inherent in the device. The second consideration is more seriously detrimental to both speed and accuracy. In addition to the large size of the detail, from a viewpoint of trained personnel required, four settings mean four chances of error and the multiplication of four small "accidental" errors in exact settings. Though the simultaniety of the settings saves time, the fact of four individuals further weakens the accuracy and certainty of operation of the device. Moreover the

four settings cannot be checked as "set" simultaneously, so that some time is lost. We should therefore expect only fair results at best and at times quite erratic results with this device under average conditions. Such were the actual results with one used during the past season though the board was made by a skilled ordnance machinist and was operated throughout the season by one officer personally, the observers also being officers in the case of some firings. The system suffered somewhat from lack of proper observing instruments, though this was corrected by use of the observation telescope described above in the latter firings of the season. It must be added, too, that the results, though sometimes erratic, as stated, were nevertheless better than those gotten with the non-service makeshifts which have been employed heretofore. And the introduction of this device marks a distinct epoch in artillery firing methods. It is a mark of progress from target practice to real artillery firing. However the device is not entirely satisfactory for the reasons stated and for the additional reason, which has not been discussed, that the system of using it has not been fitted smoothly into the drill of the battery which it is serving. Before taking up this matter, however, another method of solving the spotting problem itself will be considered.

There were considered above narrow pencils of rays which were conceived as surrounding the OT lines. Let us now actually construct such pencils on long narrow strips of transparent celluloid such as photographic film. The lines should be made very fine, photographically, and each .25° line should be heavier to facilitate reading. On the right of the median line the rays should be red, on the left black. The value of the .25° rays should be indicated in figures at short intervals. Now consider each of these pencils wound upon two spools, a middle portion of about 2500 yards being between the two spools in each case. The two spools for each pencil are mounted rigidly at this distance apart (the secondary being somewhat longer than the primary) and the units so formed pivoted at the center of the board so that the pencil segments may be moved freely in azimuths, the intersection of their median lines remaining at all times the exact center of the circular board. Figs. 3 and 4 (q. v.) show this mounting detail. One spool of each pair should contain a spring to keep the film taut, and the other should be equipped with a knob by which the film could be wound from one spool to the other with changes in range. The spool with the knob should move with sufficient firiction to stay set in any position. The secondary unit is sufficiently longer than the primary that each moves in azimuth entirely free from obstruction of the other so that their median lines may be set in coincidence or at any angle of intersection desired. The board itself is scaled into a rectangular grid such as has been described above, except that in this case there is no need for transparency. It should be conspicuously colored and marked to facilitate reading and to distinguish at a glance "overs" and "shorts." This can be done by different colored graduations, indicating on either side of the heavy zero line the "overs" in bright yellow-orange, for instance, and the "shorts" in blue (these colors not being easily confused with the red and black of the ray pencils). These graduations should be finely drawn and shaded in the usual manner to indicate hundreds and fifties. The scale may be further accentuated by coloring the bands 0-100, 200-300, 400-500, etc., "over" pale yellow and the corresponding bands "short" pale blue, leaving the intervening bands white, and writing the value of the bands in large outlined figures in the center of each in the appropriate color. This great amount of detail may seem trivial. But it is usually details, even trivial ones, which make the difference between success and failure. The ease of reading a scale, however, particularly in such a case as this, is not trivial, but of vital importance. Around the circumference of the board is a fixed azimuth circle. The board is mounted to rotate within this circle and carries a pointer to its inner limb. The rotating pencil segments, as described above, carry pointers to its outer limb, each limb being graduated in proper orientation.

The board is located in the plotting room near both the plotting board and the range or elevation correction board. When the setforward point has been

targed its range and azimuth are called off in the usual way and the range set by the spotter on his splash clock. The B′ arm is brought up (as it is brought up now on the predicted point in many mortar batteries where the B′ station is the BC station) and the range to the nearest hundred is called off by the plotter as a signal to the armsetter to "read." The armsetter thereupon calls off the azimuth exactly.* The spotter sets both these data on his B′ pencil segment as they are called and repeats the azimuth by telephone to the B′ spotting observer, who sets his instrument accordingly. The B″ arm is brought up almost simultaneously in the same manner. The B′ arm having been "cleared" as its azimuth was read, the B″ arm is trued on the targ and its range and azimuth called off and set in the same manner as the B′ data. The spotter calls "one, two, splash!" with the bells, his attention focussed upon the B′ pencil. The B′ spotting observer calls "right" or "left" so much (ex. "right twenty-five"), and the spotter sets a xylonite straight edge which he holds in his left hand upon that ray, repeating "right twenty-five" and shifting his attention to the median line of the secondary pencil. The B″ spotting observer thereupon calls "in" or "out" so much (ex. "out sixty-five") according as the splash is on the inshore (battery) side of his OT line or on the outshore (away-from-the-battery) side of it. The spotter runs his targ or pencil "in" or "out" along the straight edge to the proper ray and, shifting his attention again to the conspicuously striped and colored grid, calls out "over" or "short," and, looking more closely, adds the exact amount to the nearest ten yards. The entire process should be completed within five seconds after the splash.

This board should be made according to a standard design and with the usual finesse of fire control instruments to insure accuracy. In particular the ray pencils must be mounted to rotate about the exact center of the grid, flush with its surface, and with just enough friction to remain set in any position. The practical details of the design should be worked out and perfected by skilled ordnance officers and machinists to whom such matters are routine. There could certainly be no difficulties encountered in attaining the ends indicated.† A scale of about 200 yards to the inch would appear most convenient. The main scale of the pencils could cover the ranges 10,000-20,000 yards as suggested above, or might be extended to 25,000 yards if thought necessary, considering the difficulty of making the pencils. In case difficulty is encountered in making these ray films as long as suggested they may be shortened by using a reduced longitudinal scale, the rays in this case becoming curves instead of straight lines. Of course this involves a small error due to the curvature between the intersection of the median lines of the pencils and the point of splash. For example, if the longitudinal scale is one-half the lateral scale and at range x a splash occurs 500 yards over, the divergence of the rays of the pencils at that point is correct for range x plus 1000 instead of x plus 500 as it should be, and the error is that which would have resulted from setting the range 500 yards in error on pencils drawn to full scale longitudinally. This error is relatively small for the average deviation (averaging perhaps 5% to 10% when cumulative for the two pencils) and might be outweighed by considerations of simplicity in making the scales. However, such an error should be avoided if at all practicable. Plain paper grids should be supplied for spotting above or below these limits to the smaller or larger scale. These lower scale grids may also be conveniently used to further speed up adjustment corrections by using the half, third, or fourth scale grid, etc., for the second, third, or fourth shot; the spotter, instead of calling "over" or "short" so much, calling "down" or "up" the amount his scale reads, in accordance with the method of fire adjustment employed. An assistant spotter would be definitely required in this case.

The advantages in the operation of this spotting device are obvious. The most important are: (1) it requires but one operator in addition to the spotting observers, although an assistant spotter may be used if available and desired.

* A slide rule may be used instead for this operation, as discussed later.
†See Note, Fig. 4.

(2) Everything is "set" *before* the splash. After the splash the operator has but to locate the intersection of two rays already drawn and set on his board and call off the deviations determined thereby on a conspicuous scale already in place. (3) Since the pencils and grid are constructed with absolute accuracy (within possibilities of reading) there can be *no error whatever* (within practical limits) in the computations made by the board. Spotting data determined by this board should be practically accurate within ten yards. (4) Finally, as has been mentioned, the data should be called off to the range correction board operator within five seconds after the splash. The obvious advantages of installation, namely small size and consequent ease of mobility, have been commented upon.

The disadvantage in the use of this system of spotting is the inconvenience to the plotting detail in supplying the necessary orientation data. It will be remembered that specification (4) above required that the spotting must not prevent the efficient functioning of the position finding service. This system requires that two extra sets of readings be taken on the setforward point in addition to those taken on the gun arm. This will require perhaps an average of five seconds more time. Any plotting section which can drill passably can perform the ordinary operations on the plotting board within 15 seconds. Supplying the spotting data would therefore lengthen this time to 20 seconds, which would leave the plotter but 10 seconds to draw in lines of direction and estimate the future course of the target. A good plotter with good armsetters would have more time, and for a good plotter the 10 seconds would be sufficient, particularly since these spotting data are only supplied for bells on which shots are fired. But if the time should be insufficient in any particular case it would not materially affect the accuracy of the data nor to any great extent if any the rapidity of fire to lengthen the observing interval 30 to 35 seconds. In cases where the B′ station is the directing point of the battery, which should be the case wherever possible, only the B″ spotting data in addition to the regular firing data are necessary. This is simpler than determining the azimuth of the predicted point as is done at present in all mortar batteries, since it is not necessary to move the targ. Of course in mortar batteries this must be done *in addition* to determining the azimuth of the predicted point. Finally, if this disadvantage prove to be a serious one it may be entirely removed by use of a slide rule which converts range and azimuth from directing point to setforward point (taken directly from the plotting board) to range and azimuth from the spotting station. Such a slide rule may be made universal and accurate within .02 degrees in azimuth.* In range such accuracy is not required. In this case the spotter transmits to the spotting observers the uncorrected range and azimuth of the setforward point as called off from the plotting board. Each observer works out his own range and azimuth, sets his instrument, and reads the orientation data for the spotting board back to the spotter, who sets it. The deviations are then sent at the proper time as described above. The use of this slide rule would probably require an assistant for each spotting observer.

In case the spotting is done on the target instead of on the setforward point, which is but a rough process at best, even if the actual deviations are determined to the yard, it is sufficiently accurate to keep the ray pencils set by azimuths read to the nearest degree from time to time by the spotting observers—for instance immediately after the shot is fired. The ranges can be set to the nearest thousand yards by data from the plotting board. This, of course, does not inconvenience the plotting section in the least. The accuracy of the spotting data even with the approximate settings should be within 20 yards. However, since this deviation is measured from the point at which the target happened to arrive at the instant, it may differ widely from the true deviation from the point on which the gun was laid.

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* The description of this slide rule cannot be undertaken here. A working model has been made, however, and is now in process of revision toward greater simplicity of operation.

If the deviations are measured from the target, moreover, one spotting system may be made to serve several batteries simultaneously. In order to accomplish this result under service conditions, however, the firing of each battery must be made to follow a definite schedule. Such a scheme has been proposed by H. H. Blackwell. It provides that all firing data be computed for the successive predicted points (which means a marked simplification of the plotter's work) and that the device which corresponds to the splash clock supply the gun commander with proper firing bells, which must naturally vary with the time of flight. In accordance with this system the splash must always occur *on the T. I. bell.* There could therefore, according to this system, be no better spotting observers than the regular B′ and B″ observers with their D. P. F.'s equipped with splash scales, the observer calling off the deviation of the splash while the reader calls off the azimuth of the target. The matter of selecting the proper splash when several batteries are firing is thus reduced to its simplest form (the T. I. bells of the several batteries not being in synchronism) and the entire spotting detail reduced to one man. This is the case whether multiple spotting is used or not. But, as stated at the outset, only under this system or a similar one can spotting be conducted for more than one battery at a time. According to this system six different guns or batteries could easily be accommodated by setting their T. I. bells 10 seconds apart according to a definite schedule. This system of firing on the predicted point simplifies both plotting and spotting, whatever system of either is used. The simplified system of spotting described in this paragraph, however, it must be remembered, is seriously defective in that it refers deviations to the target rather than to the setforward point. Its great simplicity commends it, nevertheless, as an emergency method in the case of reduced trained personnel, and this consideration alone warrants the equipping of all D. P. F.'s with splash scales and pointers. The flexibility of fire control switchboards in all up-to-date coast defenses at the present time would permit the necessary alteration in telephone connections without difficulty.

We shall now summarize the several points which have been developed in connection with spotting, and state in more or less succinct form decisions reached and conclusions drawn from the discussion as a whole. In the first place we have noted that there is at present a vital *necessity* for a standard and effective *service* system of spotting for artillery fire, with the necessary instruments for its installation. Since position finding and spotting are always conjointly necessary and mutually coordinate and interdependent, economy, simplicity, and security demand that the two should be bound together into one composite system, each battery being served by its own system which may be temporarily or permanently assigned to it. This implies a standard system of bi-lateral spotting to correspond with the plotting system now in use. The maximum effective range of this composite system is 25,000 yards, which is practically covered by the present position of finding service. Fire beyond this range is a special problem of relatively minor importance to be solved in cooperation with the air service. The interests of accuracy demand that the solution of the spotting problem be based upon observed angular deviations (not azimuths) of the splash as viewed from the observing stations. Correct adjustment of fire demands that the deviations be measured from the setforward point instead of from the target. According to the present system of drill these deviations cannot as a rule be measured on the observers' D. P. F.s, even if the instruments were equipped for this purpose. However, for emergency use and use with different systems of drill the D. P. F.'s should be provided with a splash scale and pointer. There should be provided as regular equipment for the spotting observer a special observation telescope which has been described in some detail above. Its essential features are two independent traversing knobs, with proper scales, and a finely graduated splash scale and pointer. These instruments should be supplied to all batteries at the rate of one per observing station (or per D. P. F.). An extra telephone is necessary from each instrument to the switchboard. There are prob-

ably sufficient spares in the cables already laid to accommodate these instruments. However in the future allowance should be made for them.

The simplest device for effecting the solution of the spotting problem from either azimuths or observed deviations of the splash is an extra plotting board from zero or normal in addition to the simple fixed subscales provided at present. All arms of plotting boards should be provided with movable index boxes of this character in addition to the simple fixed subscales. They allow greater flexibility in position finding as well as in spotting. In addition a simple spotting grid such as has been described above should be supplied for each plotting board used for spotting purposes. In order to take care of the case of batteries which have but one plotting board, and in order to provide an alternate plotting and spotting board for batteries which have two plotting boards, a second spotting device must be devised. Since the plotting board, considered as an additional installation, possesses disadvantages of large size and small scale, great weight and consequent limited mobility, and all the concomitant inconveniences of these characteristics, a new spotting board should be devised which contains the essentials of the plotting board but eliminates the unessentials. The essentials are the intersecting OT lines, which are represented on the plotting board by the fiducial edges of the arms, and an area of perhaps 1200 yards radius (to a convenient scale of perhaps 200 yards to the inch) around their intersection (the target point) upon which the spotting problem may be solved. A practical but imperfect solution of this problem has been reached in the Cole spotting board. A more effective solution consists in a somewhat similar mounting upon transparent celluloid film actual ray pencil segments surrounding the OT lines, with provision for their proper orientation, so that an impact may be located at once as the intersection of two rays already set before the splash. The deviation of the splash from the target point is read at once from a conspicuously graduated grid similarly set before the splash. The details of this device and its use are described above.

Each battery then has as its spotting equipment the following:

Observing Instruments: *Regular:* Special observation telescope per observing station, with telephone line switchboard. *Emergency:* Regular observer's D. P. F. equipped with splash scale and other pointer.

Spotting Boards: (for batteries with two plotting boards) *Regular:* Second plotting board equipped with movable index boxes on arms and with spotting grid. This board can furnish accurate spotting data from the setforward point only. *Alternate: (when second plotting board is used for position finding, or when emergency demands)* Portable one-man spotting board described above. This board has the necessary flexibility for any kind of spotting.

Spotting Board: (for batteries with one plotting board) Portable one-man spotting board described above. It may be used with either regular or emergency observing.

Splash Clock: One per battery, as described above.

This equipment supplies every battery with an effective regular and emergency *service* spotting system which can furnish accurate spotting data measured from either setforward point or target under all conditions under which the battery's position finding service can operate, and within five seconds after the splash. It requires a minimum of one, an average of three or four, and a maximum of six operators, including observers.

Changes In Designations Relating to Coast Defenses

Paragraph V, of General Orders No. 13, War Department, June 9, 1925, is of such vital interest to Coast Artillerymen that it is here published in order that it may be available for ready reference:

1. To the end that the designations of units comprising the fortifications of the United States may be more truly descriptive, and that they may more nearly

conform to the terms used in other branches of the service, the following changes therein are made:

a. The principal harbor defense tactical and administrative unit, heretofore designated the "Coast Defense Command," will hereafter be known as the "Harbor Defense," the commanding officer of such a unit will be called the "Harbor Defense Commander," and his staff the "Harbor Defense Staff."

b. The unit heretofore designated the "Fort Command" will hereafter be known as the "Fort."

c. Units heretofore designated the "Fire Command" and the "Mine Command" will be known as the "Group."

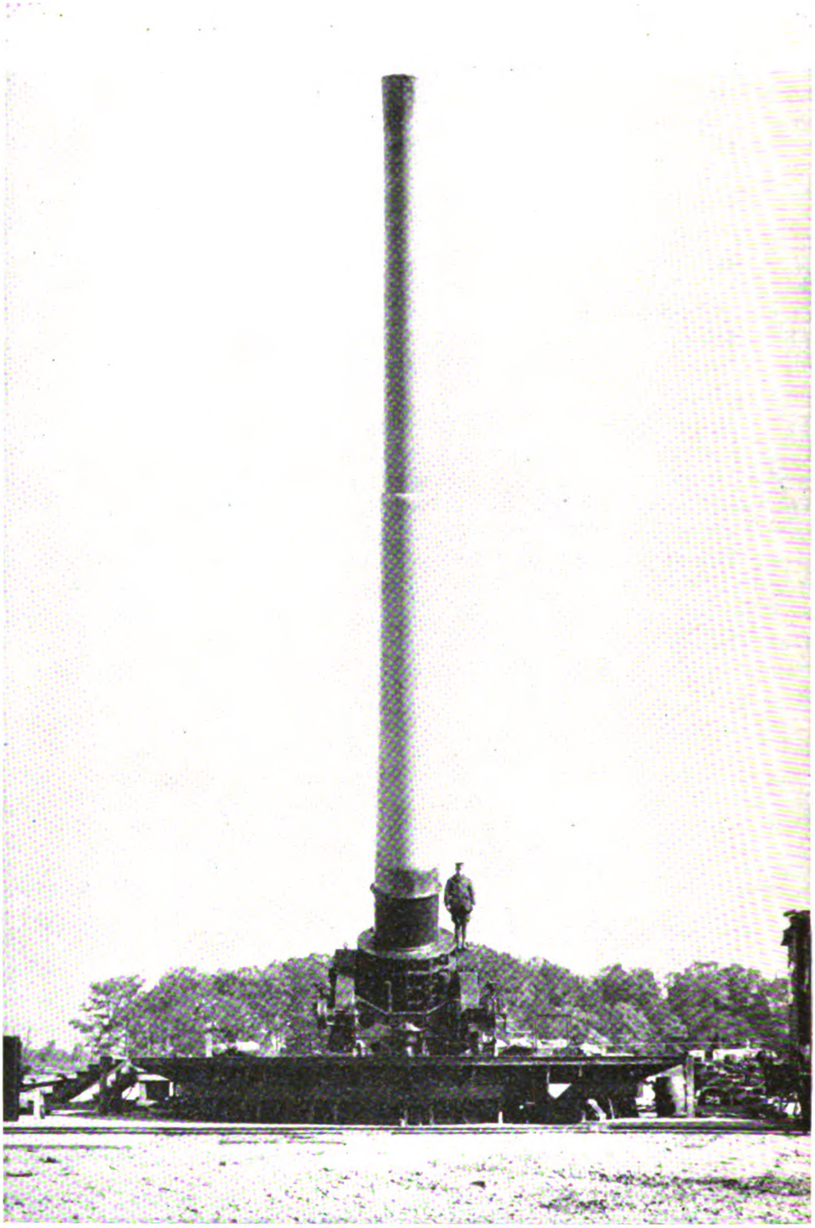
2. It is not praticable to revise and republish all orders, Training Regulations, Army Regulations, and other War Department publications in which the designations of these units appear; nor is it considered practicable to issue detailed changes in such publications to effect these corrections, as the instances where these designations are used are so numerous as to render such action uneconomical.

3. In the first column of the tabulation in paragraph 5 are enumerated old designations and in the second column the corresponding new designations of units referred to in paragraph 1; and wherever the terms shown in the first column now appear in any publication issued by authority of the War Department, the corresponding terms shown in the second column will be substituted therefor.

4. Hereafter in all official correspondence between officers and individuals in and under the War Department, and in all orders, bulletins, circulars, regulations, and other official publications issued by authority of the War Department, where mention is made of any of the units referred to in the tabulation in paragraph 5, the designations shown in the second column of that tabulation will be used.

5. *Old and new designations:*

Old Designation	New Designation
Coast defenses of	Harbor defenses of.
These coast defenses This coast defense This coast defense command	This harbor defense.
Fixed defenses	Harbor defense (includes both fixed and mobile armament).
Fort command	Fort.
Fire Command Mine Command	Group.
	Harbor defense command post.
Fort commanders station or command post.	Fort command post.
	Group command post (first group, second group, etc.).
Battery commander's station or command post.	Battery command post.
Primary station, fire command Primary station, mine command	Primary station (first group, second group, etc.).
Double primary station, mine command	Double primary station (first group, second group, etc.).
Secondary station, fire command Secondary station, mine command	Secondary station (first group, second group, etc.).
Double secondary station, mine command.	Double secondary station (first group, second group, etc.).
Supplementary station, fire command Supplementary station, mine command	Supplementary station (first group, second group, etc.).
Separate observing room	Observation post.



LATEST TYPE OF LONG RANGE GUN

16-INCH GUN, MODEL 1919 MII. LENGTH 50 CAL.; MAX. ELEV. 65°; MIN. ELEV. 7°; M. V. 2700 F. S.; MAX. RANGE, 50,000 YDS. MOUNTED ON 16-INCH BARBETTE CARRIAGE, MODEL 1919. LOADING ANGLE, 4°; TRAVERSE, 360°.

A Tactical Inspection

EDITOR'S NOTE: *The Commanding General of the Third Coast Artillery District recently made a tactical inspection of the Coast Defenses of Chesapeake Bay. The instructions issued prior to the inspection are published below in order that they may be available for study or use in preparing for future inspections of a similar kind.*

1. GENERAL ASSUMPTIONS.

a. The General Situation 9 (12 hr. 7 June 1925).

(1) A state of war was recognized on 15 April 1925 between the UNITED STATES (Blue) and a strong combination of maritime powers (Black) is now operating in the Western Atlantic.

(2) THE EASTERN FRONTIER COMMAND is in a position of readiness: this includes the 3D SECTOR, which in turn includes the NTH SUB-SECTOR: limited by the R. R. line RICHMOND—WEST POINT, VA. (all inclusive) —YORK RIVER (inclusive)—CHESAPEAKE BAY (exclusive except for sphere of action of armament)—HAMPTON ROADS and JAMES RIVER (both inclusive).

(3) The following is the present disposition of ARTILLERY in the NTH SUBSECTOR:

(a) Under direct command of subsector commander:

(1) 52d C. A. (Ry) emplaced at FORT EUSTIS, VA.

(2) 51st C. A. (Tr) emplaced at GRAND VIEW, VA.

(3) 61st C. A. (A. A.) emplaced to cover FORT MONROE—GRAND VIEW Area.

(4) 53d C. A. (Ry) in reserve at RICHMOND, VA.

(b) Under direct command of Commanding Officer Coast Defenses of Chesapeake Bay.

(1) 12th C.A. (HD) manning fixed batteries at FORT MONROE, VA.

(c) The artillery at FORT STORY, VA., is assumed to be in the NTH SUBSECTOR.

(4) There are important enemy objectives in the vicinity of YORKTOWN, VA., and NEWPORT NEWS, VA.

(5) The missions of the above regiments are as follows:

(a) 52nd C. A. (Ry). To deny the enemy the use of the JAMES RIVER and YORK RIVER and to be prepared, with minimum delay to move to a new position.

(b) 51st C. A. (Tr.). To deny the use of the waters within their range to unarmored enemy vessels and to be prepared, with minimum delay, to move to a new position.

(c) 61st C. A. (A. A.). To deny the use of the air to enemy aircraft within range of the regiment's armament.

(d) Coast Defenses of Chesapeake Bay, 12th C. A. (HD). To deny the enemy the use of the waters within range of the armament manned.

b. The strength of the 61st C. A. (A. A.) and the 12th C. A. (HD) is assumed to be that authorized in Table of Allotment C. A. C. 12020, August 4, 1924, namely: 12th C. A.—25 officers and 443 enlisted men; and 61st C. A.—13 officers and 329 enlisted men.

c. The total allowance of ammunition available is sufficient to meet the demands of four hours fire action.

d. For tactical purposes the waters to the EAST and NORTHEAST of FORT MONROE are assumed to permit maneuver of BLACK battleships as close as the extreme range of major caliber batteries.

2. GENERAL REQUIREMENTS.

 a. Due to the absence of its personnel now with the 62d C. A. (A. A.) at Fort Totten, N. Y., the 61st C. A. (A. A.) will stand the inspection without materiel and will use only officer personnel and recorders, grouped about the regimental commander.

 b. The 12th C. A. (HD) will man the stations and communication system now assigned: the armament will not be manned. Recorders will be provided for all tactical orders, messages, and reports.

3. At 9:00 A. M. June 10, 1925, the District Commander, with his staff, will arrive at the Command Post to be selected by the Coast Defense Commander near which will be assembled the Commander of the 61st C. A. (A. A.) and his group of officers and recorders. From time to time special situations will be given to the two commanders; based upon these, estimates will be made, decisions reached, and orders given whenever the special situation demands it. This will be carried on down to include the batteries.

4. The tactical inspection will involve:

 a. Attack on enemy aircraft.

 b. Attack on enemy watercraft.

 c. Employment of supporting artillery that will be made available.

5. Whenever it may be necessary in the tactical inspection to make assumptions, of whatever nature, within the problem to give full play to the tactical and technical possibilities of the exercises, this will be done: report being made to the next higher commander.

6. There will be given to the District Commander at the commencement of the inspection the following:

 a. From the Coast Defense Commander, the Fort Commander and the Commander, 61st C. A. (A. A.), complete orders and detailed arrangements for the movement of the 61st C. A. (A. A.) from garrison status to their positions and for the movement of the 12th C. A. (HD) from garrison status to a position of readiness at their armament.

 b. From the Commander, 61st C. A. (A. A.) a rough sketch showing the battery positions, stations and communications that would actually be used under the conditions.

7. At the end of the tactical inspection all officers of the two regimeuts will be assembled with complete records and a critique will then be held by the District Commander.

8. Immediately thereafter the complete record of all orders and communications sent and received during the special situations will be gathered together by the Coast Defense Commander and the Commanding Officer, 61st C. A. (A.A.) and handed to the District Commander.

 NOTE: The above was furnished Commanding Officer several days prior to the Inspection.

SPECIAL SITUATIONS

As each special situation is handed the Commander concerned, he will note the time, study the problem involved, and then give in order (when appropriate):

 a. The estimate of the situation.

 b. His decision.

 c. All necessary orders.

SPECIAL SITUATION No. 1.—(Time: 9 hr. 10 June 1925). The subsector commander has placed at the disposition of the Commanding Officer, Coast Defenses

of Chesapeake Bay, a battery of two 12-inch Railway Guns, Battignolle mount, with two hours ammunition (A. P. shot) with materiel for enmplacement and necessary working and manning parties from 53d C. A. (Ry).

a. Where would you emplace the battery?
b. What base lines would you provide for the battery?
c. What tactical disposition would you make of the battery?

Special Situation No. 2.—(Time: 9 hr. 20 min. 10 June 1925). Information received that Black has established airplane base in Delaware Bay and is contesting with Blue for air superiority.

Special Situation No. 3.—(Time: 23 hr. 11 June 1925). A Black fleet including battleships, destroyers and transports, with temporary air superiority, has forced the entrance to Chesapeake Bay during the afternoon and night of June 11th. What searchlight dispositions will be made for the night,

(1) By Coast Defense and Fort Commanders,
(2) By Commanding Officer, 61st Regiment (A. A.)?

Special Situation No. 4.—(Time: 2 hr. 12 June 1925). Destroyer division Northeast of Fort Monroe moving North in line ahead picked up by searchlight. Range about 8000 yards.

Special Situation No. 5.—(Time: 5 hr. 12 June 1925). Battery of 12-inch guns, Battignolle mount, ready for action. Weather hazy, visibility poor. At least two battleships seen from time to time Northeast of Fort Monroe moving North, within range of 12-inch mortars and 12-inch guns.

Special Situation No. 6.—(Time: 8 hr. 12 June 1925). Weather clearing. Black bombers with pursuit protection approaching Fort Monroe from the Northeast.

Special Situation No. 7.—(Time: 8 hr. 30 min. 12 June 1925). Black bombers destroyed battery Montgomery (6-inch). When informed of this, the subsector commander placed one battery of the 51st C. A. (Tr) at Grand View at disposal of Coast Defense Commander. What preparations would be made to use it to cover Hampton Roads?

Special Situation No. 8.—(Time: 9 hr. 12 June 1925). Black now has air superiority. One division of Black battleships in line abreast closing in on Fort Monroe from Northeast. Another division of Black battleships entering Main Ship Channel in line ahead. Black observation planes coming over Fort Monroe.

Special Situation No. 9.—(Time: 9 hr. 10 min. 12 June 1925). Periscopes of two submarines entering Hampton Roads now visible.

Special Situation No. 10.—(Time: 9 hr. 30 min. 12 June 1925). Both Black Divisions of battleships now within range of batteries.

Note: For obvious reasons information, which would be available, can not be given here to assist in solving portions of this problem.

Antiaircraft Defense in Flanders

[*Translated from the* German Press]

General.—Unrestricted submarine warfare against trade commenced in 1917. In a few months it attained the importance of a decisive factor in the war. As was to be expected the enemy replied by strong offensives against the 4th Army, which protected the sea bases on the Flanders coast. The outcome was the battle of Flanders, which started with extensive operations in the air, increasing in

intensity all through the battle. After the collapse of the enemy's offensive on land the attacks by air increased still further, attaining their culmination point in the summer of 1918. Here, on the north wing of the western front, measures were taken to fight a decisive battle in the *air* for the domination of a portion of the *sea*, the progress and full meaning of which are of special interest as touching similar combinations in a future war. The headquarters command of the Naval Corps had made extensive preparations in good time. With the steadily growing success of the submarine war the Supreme Army Command also soon became convinced of the correctness of the demands made, and promised to render every possible assistance. Notwithstanding all elaborate preparations, the strength of the aerial forces employed by the enemy in time probably exceeded every conception and all expectations. Nevertheless the enemy left us a few month's time to elaborate our measures of defense. By so doing he enabled us to stave off, for the time being at any rate, an adverse decision against us.

The Preparations.—German preparations for aerial warfare comprised the reorganization and augmentation of the sea and land planes, and in combining the various sections of antiaircraft artillery under one command as the antiaircraft forces of the Naval Corps. Up to the beginning of 1917 antiaircraft operations by artillery was one of the duties of the Artillery regiments. Now four groups were formed:

1. The Coast group, with batteries from St. Paul to Mariakerke, which again was subdivided into two subsidiary groups, Zeebrugge and Ostend. Tactically the batteries of the army-antiaircraft gunnery school in and around about Blankenberghe were attached to them. Divisional Commander: First Lieutenant of Reserves of M. A. Hoffman at Zeebrugge.

2. The Bruges group, which from a tactical point of view soon developed into the focal point. The Naval antiaircraft battery at Ghent was part of its organization. Divisional commander: Lieutenant J. N. R. of M. A. Hollweg at Bruges.

3. The West group with front towards Middelkerke-Lombardsyde-Dixmuiden, at times augmented by an army antiaircraft artillery group and always held by naval and army batteries. Divisional commander: Lieutenant J. N. R. of M. A. Reymann at Ghistel.

4. The Bavarian antiaircraft machine Gun Division No. 3. Owing to conditions at the front less capable of independent action than others, yet this division performed excellent services in cooperation with antiaircraft guns and aviators, in the intelligence service and in the training of machine gun crews.

At times it was successfully employed in combination with other sections as an infantry machine gun force on the land front. Divisional commander: Captain Bosmiller at Stalhille.

We get an idea of the rate of development of this service when we look at the available artillery park in active service at the front (15, 12.5, 10.5, 8.8, 7.7, 3.7, cm guns): in 1917 about 70; in 1918 about 212. To these must be added kites and balloons at about 120 flying stations, mainly round about Bruges and subordinated to that group. Kites and balloons were not nearly so much in evidence at the locks at Zeebrugge, and were little used, at the request of the seaplane pilots.

The extension of the intelligence service proceeded hand in hand with the augmentation of fighting material, the reliable and quick working of the former being a matter of supreme importance in aerial warfare. Each battery was furnished with 2-3 observation stations, fitted with the best optical and acoustic in-

struments. They were dispersed all over the country, wherever possible combined with searchlight stations, towards the enemy and on the frontiers numerically as strong as possible, and fitted with their own widely extended net of telephone connections. Their reports were collected in three central aviation intelligence stations, sifted and arranged, and passed on to threatened points, last of all to headquarters at Bruges. By this means danger was best averted and cooperation of all concerned assured. The searchlights were combined into groups of 3-4 and were not tied to any one particular position. The leading searchlight of each group was entrusted with the duty of announcing the direction in which the enemy was advancing, and the duty of the others was the illumination of the targets. The batteries were furnished with the very best measuring instruments, and partly with shooting appliances for antiaircraft guns. Batteries in fixed positions were mostly commodious and well concreted outfits with fixed positions for the guns. Movable, i. e. interchangeable positions were only provided for in the West group, where occasional very heavy enemy artillery fire made such an arrangement necessary. The guns from 7.7-cm. downwards naturally made the very best possible use of their mobility, likewise the 8.8-cm. railway-truck guns. As regards the remainder, the good but heavy artillery, and also the nature of the objects to be protected made fixed positions for the guns an absolute necessity.

Permanent theoretical and practical courses of instruction looked after the training of the personnel. They were also regularly attended by men of the fleet and from home, and also at times from our allies. Lively intercourse with the army antiaircraft gunnery school led to exchange of experience. But the best teacher of all was the enemy with his never ceasing activities. When in the summer of 1917 he began to become a heavy burden, the strength of the force had been built up to about 50 per cent of the ultimate strength in view.

Up to then the focal point of the fighting on land at Ypres had acted like a magnet on the bulk of the enemy's aerial forces. The French aviators, who were not much feared, soon disappeared from the coast entirely, and were replaced by the far more resolute and indomitable English. Imbued with extraordinary personal bravery, the English air forces also endeavored to adapt themselves materially to the new measures of defense adopted by us. The excellent de Haviland and Handley Page planes soon doubled the altitude to which they were able to rise, to avoid or diminish the danger zones. That fact apparently put an end to kite and balloon barrages. In actual fact it protected the objects surrounded by them against attacks by low-flying planes, which are by far the most difficult to fight against. The increased altitudes of enemy planes, however, benefitted us also, as they reduced the difficulty of aiming at quickly moving targets, and as a result the work of the antiaircraft guns as regards time and stability, observation and steadiness of aim, improved. On the other hand the artillery lost in breadth of range what it gained in height, and that meant increasing the number of guns. It had to be done, however, and the admiralty in the end voted, before it was too late, that which the Supreme Army Command could not grant, although many a time a hard battle with pen and ink had to be fought to get it. Before long the enemy presented us with new bombs of great explosive power and considerable weight.

Thus on both sides the year 1917 was chiefly notable for increase of materiel for aerial warfare. On the other hand one could not as yet discern anything in the nature of aviation tactics, properly so called, on the enemy's part. The enemy made good use of flying weather, tried to get at the target, but as a rule promptly

cleared off without reaching it when he got within range of our artillery fire. He evidently still lacked ingenuity to side-track our measures of defense. In the tactical race we were just about a head's length ahead of him. This proportion naturally was fraught with the danger of our settling down into a groove. But we were not kept waiting very long; an impulse, suggesting the advisability of keeping awake and progressing, came very soon.

Tactical Developments.--In keeping with the tactics of the enemy, measures of defense were very simple at first; in the daytime and by searchlight firing at visible targets, and when all was dark blockading fire at various altitudes over the object to be protected. In all these the great speed of the moving targets called for intensive fire in sudden bursts.

In the scientific and practical development of antiaircraft gunnery distinguished services were rendered by the Chief Adjutant, First Lieutenant of reserves of M. A. von Sanden, who was at one time professor of mathematics at the University of Gottingen. Of convincing lucidity in speech and in his writings, and himself deeply imbued with the correctness of his methods, he earnestly but yet also with a spirit of humor faced all the manifold difficulties that had to be dealt with, assiduously teaching and instructing, and well versed in all the phases assumed by criticism. The point was, to adequately express in the simplest form of a military command the four elements which were constantly influencing each other, namely: altitude, distance, vertical and lateral deviation. The latter was not really satisfactorily achieved until the year 1918. The high rate of speed of 40-70 m/sec. at which the targets were moving, and the free tridimensional mobility of the same preclude all possibility of rectifying fire. The natural dispersion of barrels and fuses permits and favors the abandonment of graduated ranges. Hence the method adopted: a volley fired at command by batteries of as many guns as possible; two or three volleys in quick succession; waiting for result of lateral observation; and with corrections accordingly a new sequence of volleys. Assuming, of course, a high velocity of the projectiles and absolutely reliable fuses. In practice it was at times found to be a good plan to have the fire under dual control, one officer giving altitude and range, another altitude and lateral correction. This method permitted of many variations, and was used together with single control; the nature of the work in hand called for quick adaptation to conditions as they presented themselves; hard and fast inflexible rules were out of place.

Basing its methods upon the experience gathered by the force as a whole under all sorts of conditions, the leaders of the antiaircraft forces gradually confined themselves to restricting the latitude allowed to the batteries, and so were able to build up useful practical rules.

Blockading fire was developed on similar lines. The aviator, invisible in the darkness, was only discernible to the ear. Consequently the opening of blockading fire always depended upon the individual faculties of the observer at the object of attack. The bulking together of bursting shells, fire distribution and fire discipline were matters under control of the group or divisional commander. The success of antiaircraft measures was at all times, but especially at night time, in a very great measure dependent upon harmonious cooperation between batteries, intelligence and searchlight service, both in the sector and throughout the force all along the line. The more promptly and accurately the local command was notified of the approach of the enemy, the greater the chances of success of the measures of defense. At the same time it was necessary to refrain from excess of zeal in transmitting reports, and not to be too lavish in sounding the

alarm. Bruges and the Coast in 1918 had to repulse a bombing attack about once every two hours, if flying weather was favorable, and unfortunately that was the case almost all the time. On the other hand our own aviators were out and at work at the same time, so that the demands upon the antiaircraft service were extraordinarily heavy. The outcome was that quite a number of specialists grew up, specialists in seeing, hearing and distinguishing, specialists in location and in grasping the situation, all of which could only be achieved by absolute devotion to the work, and training of men and officers. Before long the Bruges section became the standard by which the others were measured. Although the other groups contributed a considerable share, yet the highest praise is due to the divisional commander at Bruges, Lieutenant J. N. R. of M. A. Hollweg. Sure and quick in decisions and always on the spot, he had the knack of imparting his own knowledge and views to every one of his subordinates, and to raise up and maintain a high standard of ambition and sense of duties in an admirable manner.

A much more thankless and difficult task was the work on the coast. To set out advanced outposts on the water was useless. The motion of the sea, wind and ships' engines interfere with the sight and hearing. Observation close in shore was subject to practically the same disturbances. The coast line therefore was always more exposed to surprises than the other positions, a hint not to build valuable factories, etc., near the coast. What the coast lacked in warning reports it had to make up for in superior vigilance and preparedness. It fully came up to expectations and all demands made upon it. That is evidenced, among others, by several important happenings in the spring of 1918. A few days before the British attempt to blockade Ostend and Zeebrugge, the aviation intelligence of the group reported that the suspicious movements of English aviators in the early dawn appeared to point to some very special operations about to be carried out. The attack that followed was recognized by the Coast group first of all, which gave the alarm to the shore batteries, and on the mole at Zeebrugge successfully attacked the English landing troops with machine guns and hand grenades. When shortly afterwards H. M. the Emperor inspected the field of action, an enemy bombing plane, unobserved, joined our own scouts. Recognized by the antiaircraft guns at Zeebrugge in the nick of time and fired upon with effect, the enemy plane dropped its bombs a few hundred meters away from its target.

A few weeks previously Zeebrugge had the good fortune to bring down the English squadron leader, Lt. Col. X. This brave and energetic leader was doubtless the life and soul of the English air force, and the originator of the enemy's bombing tactics which were such a source of trouble for us. It was he who organized and trained the daylight massed attacks with 30-70 bombing and fighting planes. These swarms, subdivided into groups of 3-4 planes each and flying in formation at different altitudes maneuvered with extraordinary skill, and made the best possible use of every aid to surprise attacks. Such as twilight, light, ground fog, low lying tumbled clouds, advance over the sea, etc. After the bombs had been dropped the fighting planes descended to low altitudes and attacked living targets and inflammable buildings with machine gun fire and incendiary bombs. Each new form of attack was first tested by the leader himself. Thus, for instance, he had made up his mind to destroy the locks at Zeebrugge. At early dawn 5000 m. up above the point of the mole, he descended, gliding at top speed, to 50 m. over the canal and the locks, in the belief that with such a surprise every attempt at alarm must fail. He paid for his first attempt by being

shot down, was wounded, taken prisoner and sent to one of the hospitals at Bruges. Intercourse with this intrepid and chivalrous opponent soon assumed almost friendly forms, and with his retirement from active operations tactical development on the enemy's side came to a standstill.

The batteries of the West group were frequently exposed to heavy fire, a sign how unpleasant their activities were to the enemy. Thus, for example, in the summer of 1917 five (it is true, very far advanced) batteries in fixed embrasures were shot entirely to pieces within ten days, and covered with about 2000 shells of heavy and heaviest caliber every day. They were reestablished more to the rear under great difficulties. Quick-firing guns and machine guns remained behind close to the enemy's lines to keep off planes attacking the trenches, and also the advanced observation stations to keep them company. About 23 km. to the rear followed the horse-drawn army batteries and to the rear of them the naval batteries in fixed positions. With plenty of fighting going on all the time the observation and intelligence service proved a very valuable adjunct in forming opinions on the general tactical position. A specialty thought out and worked by a Belgian aviator was very disagreeable for a long time, namely firing from captive balloons. These balloons sailing fairly low down, and making full use of illumination, hollows in terrain, farm buildings, groups of trees as camouflage, he made 8-10 successful attacks. Finally after exhaustive experiments and preparations, in which the Bavarian machine gun section also took part with good effect, he was successfully driven off by means of "fire screen" and ultimately shot down in descending. The courageous leader escaped wounded, and, by the way, a short time afterwards wrote us a post card, expressing his appreciation. As far back as the winter of 1917-18 the commander had felt it his duty to train and prepare the officers by giving them practical problems to solve. Theoretical results and practical experiences over and over again culminated in a demand for a combined fighting organization with the fighting aeroplanes. Close cooperation according to a prearranged plan promised to be a successful proposition. The new chief of the air forces and the squadron leaders fortunately appreciated the arguments advanced in favor of such a combination and promised openhearted support.

The guiding principles which were worked out by both branches had for their object the entangling of the enemy in combat in the air according to pre-determined plans, and to provoke or force an aerial battle on a large scale. The most satisfactory and successful outcome was the constant intimate cooperation, the playing into each other's hands, perfect in operation in every detail, of intelligence, aviation, and antiaircraft gun-service. Active participation of commanders and officers on both sides in everything connected with the solving of the problems in hand, in experiments and reconnaissance flights, tended towards the maintenance of mutual understanding, interest and, not to be despised by any means, a feeling of comradeship. Prevailing conditions, more or less permanent, in the Naval Corps favored cooperation of this kind. Under other conditions and in mobile warfare (as opposed to position warfare) such results can only be achieved if all antiaircraft forces of a General Command are united under *one* chief command.

The tactics of the enemy's night-flying planes centered first of all upon attempts to reduce the effect of our blockading fire. 4-6 planes carefully circled round an object singled out for attack, drew the blocking fire by feigned rushes, and attacked immediately *after* the fire wave, during the listening interval, or dropped their bombs *during* the fire on some other unprotected object in the

vicinity. As the dexterity of the searchlight crews increased these tricks of deception no longer worked, and the enemy thereupon favored the much more unpleasant tactics of exhaustion. Isolated big bombing planes, sailing along one after the other in marching order, kept the alarm going for hours on end, gradually collected at the attacking point and then suddenly advanced to the attack in mass formation. This led to combined night antiaircraft measures by aviators and antiaircraft guns. At intervals of about 10 km. from the main object of attack (Bruges) the foreground was divided into sectors, distinguished by electrically illuminated direction and sign posts and searchlights. In each sector, when called upon, 1-2 "C" planes patrolled the ground at a low altitude when the enemy's approach was reported. Without having searchlights trained upon it but located by its position to the illuminated sign posts, the enemy plane was in danger of being outlined against the sky and recognized by the defending plane flying beneath him. With searchlights the chances of being able to attack the enemy plane increased considerably. The first experiments after lengthy exhaustive preparations, in which the commanders took part personally, already led to a complete success: two big bombing planes of 30 m. wing spread were shot down.

Although this may have only been a lucky chance, yet the enemy felt the blow severely, and for some time gave up night attacks, and fitted himself up with dazzling lights which were to act as a light screen between himself and the antiaircraft defenses. The means were as yet imperfect, but nevertheless were well worth noting and thinking about.

When matters had reached this interesting stage further progress was stopped by the sudden order to retire. A good deal of the valuable material was fitted up in and around about Antwerp, and on November 9th it was handed over to the enemy. *We* had looked forward with perfect confidence as to what the outcome of the war would be.

In the year 1917 and 1918 it is proved that more than 400 enemy aviators were shot down in North Flanders, 133 of these were credited to the antiaircraft artillery, and the rest to the fighting airplanes. Approximately 100 were brought down by the guns in 1918.

In conclusion the question remains to be answered, to what extent the enemy's aerial attacks were successful, and to what extent they influenced the operations in Flanders and at sea. The enemy's aerial attacks undoubtedly called for a considerable increase in the quantity of antiaircraft material which Germany had to provide, but they were not able to seriously affect our conduct of operations at sea. The shipyards, depots, locks and other plants in connection with naval warfare were on no occasion seriously damaged, nor was it ever necessary to suspend work in them. The loss of men on the German side was inconsiderable; the victims among the enemy population of the occupied territory, especially in Bruges, probably amounted to a few hundred. The last mentioned fatalities practically ceased altogether as soon as a sufficient number of dugouts, cellars, etc., had been provided as shelters for the population against bombs, and once the people had learnt to take cover in them in good time. All that was achieved, therefore, in the way of material results by the big scale enemy bombing attacks was the destruction of a goodly number of old houses near the yards at Bruges.

Specimen Record of Antiaircraft Operations at Night near Bruges

Aug. 18th. Weather clear. Wind power 2. Moon rises 11:30 p. m.

A. Bruges Central Station

7:00 pm. Report from Ghent: German fighting units night flights. Pass on to Groups and batteries.—Order for Groups; Report to aerodromes: 10 pm. wire protection standing as high as possible.

9:00 pm. Report from Ghent: Start between 9 and 10 o'cl. Aviation fires on coast burning from 9:20 until further orders.—Pass on to groups and aerodromes.—To aerodrome Stalhille: Night antiaircraft planes ready to start from 10:00.

9:30 pm. Report: Wire screen standing, altitudes over 1700 m. cannot be reached owing wind high up. Balloons, as no ground wind.—Pass on to groups and aerodromes.

B. Firing Line Bruges Group

10:20 pm. Report from aerodrome Stalhille: Four "C" planes ready to start for antiaircraft operations.

10:30 pm. Report from West, Central Station: Enemy aviators audible direction Dixmuiden about 3000 m. up.—Pass on to aerodrome Stalhille.

10:31 pm. Report from Ghent: Fighting squadron started direction coast.—Pass on to groups and batteries.

10:33 pm. Report from Thourout: Enemy aviators audible over Dixmuiden about 3000 m. up.

10:34 pm. Report from Stalhille: Two "C" planes started direction Dixmuiden. Two "C" planes starting at once direction Nieuport.

10:36 pm. Report from West, Central Station: Enemy aviators south of Ghistel 3000 m. up.

10:37 pm. Report from Thourout: Enemy aviators over Thourout, 3000 m. up, direction Bruges.

10:38 pm. Order: Searchlight Group I permission sweep Thourout.

10:40 pm. Observation: Searchlight Group I lighting up.—Order: Alarm! Blockading fire I position "high," direction Yard, Railway antiaircraft guns and Lophem Artillery Depot.—Report from Ostcamp: Own aviators audible direction Ghent towards coast.

10:43 pm. Observation: An enemy big bombing plane in searchlight, battery Lophem and railway antiaircraft guns get on the target.

10:44 pm. Report Coast: Enemy aviators audible seawards Bredeene.

10:46 pm. Order: Searchlight Group II get on target. Observation: Antiaircraft guns Andreas fire at target.

10:48 pm. Searchlight Group II lighting up. Searchlights Zeebrugge lighting; fire at target at Zeebrugge.—Order: Searchlight Group I dim lights. —To observation at Yard: permission for blockade fire.

10:50 pm. Observation: Blockade fire Yard.—Blockade fire Zeebrugge.

10:53 pm. Report from St. Paul: Enemy aviators from Holland 2500 to 3000 m. up, direction Bruges.—Order: Searchlight Group III and IV permission sweep direction St. Paul.—Report from Stalhille: Own aviators over Stalhille, direction Ostend.—Observation: Bombs dropped direction Yard.—Order: Blockade fire stop!

10:55 pm. Observation: Searchlight Group IV lighting up.—Report from Damme: Enemy aviators audible direction.

10:55 pm. Damme—St. Croix. 2800 m. up. Observation: St. Croix fire at target. Order to observation at Yard: Permission blockade fire. Observation: Blockade fire at Yard.

10:56 pm. Observation: Bombs dropped direction Yard.

10:56 pm. Order: Blockade fire, stop!

10:57 pm. Order: Inner searchlights screen.—Observation: Bombs dropped direction Artillery Depot.—Order: Searchlight Group I light up Artillery Depot!

10:58 pm. Observation: Searchlight Group I lighting up; has got on target; antiaircraft guns Lophem fire at target. Railway antiaircraft guns likewise. Target covered.

11:02 pm. Batteries cease firing.

11:03 pm. Report Stalhille: "C" plane attacking.—Pass on to batteries and Searchlight Group I.

11:05 pm. Order: Alarm back, preparedness for alarm!—

11:09 pm. Report: A heavy bomb, yard entrance south; electric cables damaged, no losses.—12 bombs outside yard, to the west, 8-10 bombs outside yard, east of canal.—One bomb in town south of yard, one house destroyed, several Belgians wounded and killed.—Two bombs railway east of Artillery Depot, no damage. Weight of bomb about 200 kg.

11:16 pm. Report of batteries on ammunition used.—St. Croix: Two aviators in searchlight, well covered, one of them very shaky, after third volley veered off seawards.--Lophem: One enemy aviator well covered. St. Angree: One plane well covered, pressed hard, after 2d volley veered off seawards.—Stalhille: Approached up to 150 m., when searchlight lost the target, fired about 20 rounds mahine gun. Enemy damaged, apparently turned off southwards.

11:18 pm. Report from Coast: Enemy aviator, apparently damaged abt. 1800 m. flying away seawards.—Stalhille: All "C" planes landed, four ready to start.

Artillery Ordnance Dcvelopment

EDITOR'S NOTE: *The following notes were compiled in the Office of the Chief of Coast Artillery by Captain Aaron Bradshaw, C. A. C. Credit is accorded the Monthly Digest of Activities of the Ordnance Department, for much of the Information contained therein.*

TEST OF ANTIAIRCRAFT MATERIEL.--I recently witnessed certain tests at Aberdeen Proving Ground. The first one was a test of a 3-inch antiaircraft gun Model 1918 on auto-trailer mount. This mount had been provided with four 6-foot side outriggers in place of the old outriggers, and with four additional front outriggers. Provisions were also made for screwing the lifting jacks down and to leave them in position during firing. The steps taken as outlined above improved the stability of the mount but did not stop the movement of the top carriage during firings. As a result of this partial failure further steps were taken to improve the stability of this mount. This lead to the development of an improvised concrete block to which the mount will be anchored in position during firings. One of these blocks was constructed at Fort Tilden, and the preliminary firings indicated that it satisfactorily solves the problems which have caused so much trouble. Quick setting cement was used in the construction of this block and it set and was ready to be fired from within 24 hours. The use of these concrete blocks does not interfere with the mobility of the mount.

A test was also held to determine whether sterescopic range finders are valuable in directing machine gun fire by means of tracers. It was decided that these instruments have some real value for this purpose, and steps are being taken to arrange for more extensive service tests.

The 3-inch Auto-Fretted carbon steel gun being tested at Aberdeen Proving Grounds to determine its accuracy life has been fired 1900 rounds. It had an

accuracy of 200 yards at 9500 yards on the nineteenth hundredth round. It is expected that the accuracy life of this gun will reach 2500 rounds. The firings held started with a M. V. of 2600 f. s. and this has been reduced down to 2400 f. s. The results obtained from this gun should be contrasted with the older type guns where considerable trouble was experienced in trying to get the accuracy life up to 250 rounds.

I also inspected an Auto-Fretted removable liner tube for a 3-inch gun. This tube is so constructed that it could be easily removed in the field with the simple tools to be supplied for that purpose. The Ordnance Department believes that these removable liner tubes might be a real solution to the wear problem.

105-mm. Antiaircraft Gun.—The characteristics for the 105-mm. antiaircraft gun, Model 1927, were approved April 23, 1925, and the work on this new gun is being pushed ahead.

Subcaliber Mounting.—The manufacture and test of the subcaliber mounting for the 16-inch Barbette Carriage, Model 1919, was approved on April 16, 1925. The sub-caliber gun is a .75-mm. gun, Model 1906. This gun with its recoil machanism, will be mounted above the 16-inch gun in a bracket which will be clamped to the outside of the 16-inch gun just in front of the cradle.

Cloke Plotting Board.—The manufacture of a special Cloke plotting board for long range batteries was approved April 30, 1925. This board will be more satisfactory for use with long range guns since the plotting board, plotting and relocating arms are longer than those on the modified Whistler-Hearn boards. This means that the scales on the arms are larger. It is contemplated that this board will be issued to the Coast Artillery Board for test as soon as completed, and after the completion of the necessary test by the Coast Artillery Board, it will be sent to the Hawaiian Department for service test.

Antiaircraft Machine Guns.—Intensive development programs have been under way with a view of improving the fire of antiaircraft machine guns. The first program being conducted has for its object the development of a real effective sight for .30 caliber and .50 caliber machine guns. Sights for the .30 caliber machine guns have already been delivered and are being used extensively at Fort Tilden and have given indications that they might be real effective sights. Sights of a similar type for the .50 caliber machine gun are expected to be delivered prior to August 1st.

The second development program has for its object the supply of shoulder rests for the .30 and .50 caliber machine guns. Orders have been presented for the manufacture of 26 shoulder rests for the .30 caliber Browning machine gun and 24 shoulder rests for the .50 caliber machine gun. It is expected that these shoulder rests will be delivered to the various antiaircraft regiments at an early date.

The third development program has for its object the supply of tripods for the .30 and .50 caliber antiaircraft machine guns. The type of tripod which has given the greatest promise is designed to mount either the .30 or .50 caliber machine gun. Ten of these mounts have been delivered and are being subjected to a preliminary test at Aberdeen Proving Grounds. Upon completion of this preliminary test, these mounts are to be issued to the 62nd Coast Artillery. Similar mounts are expected to be issued to the other antiaircraft regiments at an early date.

37-MM. ANTIAIRCRAFT GUN.—The development of the 37-mm. 3000 f. s. antiaircraft gun has been progressing nicely and 275 rounds of ammunition has been sent to the Aberdeen Proving Grounds for use in the firings of this mount.

SHELLS AGAINST AIRCRAFT.—An extensive program has just been fired to determine the rates of effectiveness of the 3-inch antiaircraft high explosive shell against airplanes. The complete report of these firings has not been received, but it is understood that these firings will show that the danger area which we have been using in computing antiaircraft hits is approximately correct.

In order to determine whether it is possible to obtain a more efficient type of projectile for use against aircraft, studies are being made of various unconventional types, which are in general, modifications of the older type segmental shells. The general purpose of these studies is to determine whether it is possible to reduce by any extent the quantity of matter which is pulverized into small noneffective fragments in conventional designs.

The Mark II antiaircraft fuse is to be replaced at an early date with the Mark III type. This action has resulted from recent firings with the Mark III fuse. These firings indicated that the standard Mark III fuse is more uniform in its action than either of the other two types.

Some Quartermaster Achievements

By CAPTAIN J. V. ROWAN, Q. M. C.

On June 16, 1775, the Quartermaster Corps came into existence as the Quartermaster Department by the following resolution of the Continental Congress: "That there be one Quartermaster General for the Grand Army and one deputy under him for the separate Army." Recent investigation made in the Quartermaster General's Office and at the Philadelphia Quartermaster Corps School indicates that Congress was at that time in session at Independence Hall (State House), Philadelphia.

The ration of the Revolutionary era was pitifully inadequate. What heroic fortitude it required to exist on the following food supply may be imagined much better than it can be described. Think of this for a daily allowance: 1 lb. of fresh or salt beef; ¾ lb. of pork or bacon; 1 lb. of flour; ½ gill of spirits; and to each 100 rations 1 qt. salt; 2 qts. vinegar; 2 qts. soap; 1 lb. candles.

With the exception possibly of the item of spirits, this was truly an iron ration. No bread unless you baked your own; no coffee at all; no sugar, no butter, no vegetables; in fact, none of the excellent variety and unquestioned palatability that characterizes the modern mess. What a dreary monotonous diet upon which to fight seven long, weary years!

Over two and one-tenth billions of dollars were expended by our service on textiles, leather, rubber goods and miscellaneous items of a similar nature. Wool alone cost over one-half billion dollars and we utilized four-fifths of a billion square yards of cotton textiles. The necessity of completely outfitting each soldier caused clothing purchases to actually exceed the annual pre-war production of the country on many items. For instance, in 1918, socks purchased exceeded pre-war production by fifty per cent. The heaviest types of shoes lasted less than a month during intensive fighting periods. Clothing items alone, purchased and delivered by the Quartermaster Corps, to the fighting troops, cost around one billion dollars.

It would be idle to dwell on miscellaneous supplies, this in view of the fact that they involved over 120,000 separate items.

Coast Defense Day at Fort Adams

During the year 1924 and 1925 much thought was given to the subject of bringing together the commissioned officers of the various elements of the Army—Regulars, National Guard and Organized Reserves—with whom the officers of these defenses would in the ordinary course of their duties come into contact. The experiment of a general get together was tried out in 1924. This was of a social nature, although the military end was stressed to some extent. This year, 1925, a rather different program was prepared with the object in view of bringing before the officers and the civilian guests the importance of this particular coast defense in the general scheme of coast defense and more particularly the important position which they, the officers and guests, occupied in the defense of Narragansett Bay.

A problem was prepared based on the defense plans and its solution was worked out. Everybody present participated in the solution and actually saw before him the methods employed. This aroused curiosity and stimulated interest and was the subject of much appreciative comment.

COAST DEFENSE DAY AT FORT ADAMS, R. I.

The following memorandum shows the events in which all participated:

1. Thursday, May 21, 1925, Coast Defense Day, is the day set aside for assembling officers and men assigned to the Coast Defenses of Narragansett Bay and invited guests,—partly for professional, partly for social purposes. The many expressions of interest in last year's Coast Defense Day leads to the hope that it will become an established custom to have such an assembly annually.

2. Tentative program:

(1) Buffet lunch at 12:00 noon at the Service Club for all officers and dinner for visiting enlisted men with the Headquarters Battery, 10th Coast Artillery, at 12:00 noon.

(2) Target practice with 12" mortar battery at Fort Adams, by the Headquarters Battery, 10th Coast Artillery, at 2:00 p. m.

(3) Combined parade of 10th Coast Artillery and 243d Coast Artillery at 4:00 p. m.

(4) Tea at Commanding Officer's quarters, for officers, at 5:00 p. m.

(5) Supper for visiting enlisted men with Headquarters Battery, 10th Coast Artillery, at 5:30 p. m.

(6) Supper for visiting officers, staying over for the dance, at Commanding Officer's quarters, at 7:00 p. m.

(7) Dance at Service Club for officers at 9:00 p. m.

3. Boat schedule:

(1) The "Condon" will leave Providence at 9:00 a. m., for Fort Adams. Returning, it will leave Fort Adams at 6:00 p. m.

(2) The "L-43" will leave Saunderstown at 10:00 a. m., for Fort Adams. Returning, it will leave Fort Adams at 6:00 p. m.

NOTE: 1—Major Collins, 243d Coast Artillery, will arrange for the landing place in Providence and inform the personnel of his regiment. Others will be informed by Major Atwood.

NOTE: 2—The "Condon" will carry 200 passengers; the "L-43" will carry 60 passengers.

The attendance was very encouraging; the 243d Coast Artillery (H. D.) (National Guard) made a splendid showing, there being twenty (20) officers and one hundred and seventeen (117) enlisted men present. This is about twenty-five per cent of the strength of the regiment. They travelled from Providnce a distance of forty-five miles. There were thirty-five Reserve Officers present, all from Providence, New Bedford and Fall River.

Brigadier General James Parker, (retired) and Brigadier General John D. Barrette, Commanding General, First Coast Artillery District and Lieut. Colonel F. W. Stopford, C. A. C., Adjutant, First Coast Artillery District, Colonel Edward P. O'Hern, Ordnance Department, Ordnance Officer, First Corps Area and Major R. G. Herman, G. S. C., G-3, First Corps Area, were the Corps Area representatives present and Lieut. Colonel Thomas Hammond, Major H. V. Allen and eighteen other officers of the 243d Coast Artillery (H. D.). Representatives from the 544th A. A. and 489th Coast Artillery, Organized Reserves, were also present besides a number of reserve officers from other organizations.

The United States Navy was well represented by Captain Orton P. Jackson of the Naval Training Station and Captain Ralph C. Earle of the Torpedo Depot both accompanied by their entire staffs.

The municipal authorities of Newport sent representatives which included the Mayor, Hon. Mortimer A. Sullivan.

The Chamber of Commerce was represented by its President and Secretary and four members.

One of the gratifying results of the publicity was the attendance of prominent civilians among whom were Commander Marion Epply, U. S. N. R. F., Mr. Walter Andrews, Mr. George Cozzens, Mr. Andrew F. Robison and Mr. Joseph Harriman.

Considerable publicity was given the affair through personal letters and the press. Representatives from the Providence and Newport papers were present and reports of "Defense Day" were contained in all the local and Providence papers the next day.

From comments, queries and reports we have succeeded in bringing the officers into closer touch. We have aroused their interest in Narragansett Bay—their home defense. We have shown them their problems and how they are the ones to solve that problem.

"Coast Defense Day" hereafter to be known as "Harbor Defense Day" will be a permanent fixture at these Harbor Defenses of Narragansett Bay.

Effectiveness of Antiaircraft Fire

EDITOR'S NOTE: *The following is extracted from a lecture prepared under the supervision of the Antiaircraft Defense Bureau of Italy. In considering the statements of the number of planes brought down by ground fire, it should be remembered that although the speed and flying height of planes have greatly increased since the War, the present-day types of antiaircraft cannon, mach ne gun and fire control equipment are vastly superior to earlier types.*

It is the conviction of many that the only means of defense against the attacks and threats of the enemy aviation service is that of having a very powerful aviation service, which, with its combined action of pursuit and bombardment, must acquire absolute mastery over the enemy, preventing him from flying over our territory and our lines.

Now, even if we are convinced that the first indispensable element in the fight against aircraft is the possession of a strong aviation service, it is not believed that this could be sufficient in itself to afford at all times and places an adequate protection against air attacks.

An aviation service, no matter how superior numerically, technically and morally, to that of the enemy, will never be able from the first day of the struggle, to prevent that of the enemy from accomplishing or attempting bombardments, from accomplishing or attempting reconnaisance, or, in short, from trying to accomplish its own missions. If it can prevent it in one sector, it cannot do so in another; if it succeeds in bombarding one field, other fields and other aircraft will remain intact.

No matter how strong, no matter how daring, no matter how aggressive, an aviation service may be, it can never prevent, throughout its whole territory, that of the enemy from executing its multifarious actions, even though on a reduced scale.

Now, precisely on account of the difficulties inherent in antiaircraft fire, a special gun is indispensable which has special characteristics, is served by very experienced personnel who know perfectly the technique and the method of employing that kind of fire, and are constantly familiarized with the arm which represents the objective against which their action is to be directed.

And yet, notwithstanding the deficiency of antiaircraft artillery during the war, the number of aircraft brought down by it reached 129 out of a total of 540 aircraft brought down by our aviation service on our front.

The statistics of the allied armies all based on official documents yield an equal percentage (Germany, 1520 aircraft brought down by the artillery out of a total of 6554 aircraft brought down by the aviation service; France, 500 aircraft brought down by the artillery out of a total of about 2000 brought down by the aviation service).

In France, still another high percentage has been reached; and it will perhaps serve still better to give an idea of the efficiency of antiaircraft artillery; the relation between the number of shots actually fired, and the number of aircraft brought down, about 11,000 shots were required in 1916 (and) that their number was reduced to about 7500 in 1918. And this progress must be appraised in relation also to the progress which aviation made in the same period, gaining in altitude, velocity, and ease of manipulation.

These statistics have been compiled so as to include all guns which executed antiaircraft fire. If then we limit them to special antiaircraft guns alone, the proportion descends rapidly in 1918 to one airplane brought down for every 3200 shots fired, and this number can be judged at its true value, if it is borne in mind that it is much less than that proved necessary for field artillery to destroy one enemy gun.

And then we must bear in mind also to appraise the work of antiaircraft arms, that it is not only by the number of aircraft brought down that their efficiency can be determined.

The fact of obliging an airplane to fly very high, to change its route, to increase the distance traversed, to carry on a bombardment from a high altitude in the continual danger of being reached by the antiaircraft fire, hampering its work of reconnaissance and still more, its bombardment, are the positive results obtained, and are far from being negligible.

If this threat of a ground offensive should be lacking, it is a logical assumption to admit that the aviation arm would accomplish the greater part of its missions, at those altitudes at which the efficiency is greatest, and would accomplish them with so much greater effiectiveness, the greater the impunity with which it could avail itself.

And the best proof that the action of antiaircraft arms is not negligible is given by the fact that the aviation arm is continuing with diligence, its studies, its researches, as to the possibility of flying at greater altitudes, the possibility of extending continually its limits of photographic observation, as to muffling the sound of the engine, as to long distance bombardment (telebombs) as to protecting the aircraft with armor, and concealing aircraft with artificial clouds.

Fundamental Inventions

Great fundamental inventions are sometimes made possible by what appear at first glance to be mere accessories.

Printing is often called the most important invention in the history of civilization, yet it may properly be said that paper was a greater invention, since printing itself was quite useless without a cheap material on which to print. The ancients knew printing. They printed on metal; that is to say, they imprinted metal—coins, for instance—hot or cold, with dies. The Assyrians invented the cylinder press; but they had no paper, cheap and plentiful; nor even parchment or papyrus; so they rolled their cylinders over sheets of clay, and made brick books.

The Greeks and Romans, for their manuscript, used both parchment and papyrus. These were expensive; so expensive, indeed, that it was customary to use the sheets over and over again, covering the preceding writing with a thin, opaque, flexible coating. Some experiments appear to have been made in engraving a whole plate and burning or printing the impression on the parchment or papyrus. This would have been expensive in itself, but after all, the limiting factor was the lack of paper.

The Chinese knew printing. They even knew it, vaguely, as we know it now, with movable block types. They too, however, lacked paper; and without it printing was quite useless to them.

Paper was invented in Western Asia about the tenth century. It was kept a state monopoly of the Bagdad Caliphate, but no use was made of it for printing. As the Moors swung across Africa and into Spain in the middle ages, they brought paper with them. Early in the fourteenth century some of it fell into the hands of certain inquisitive Europeans who investigated its composition and discovered how to make it; and the first paper mill was set up at Regensburg.

The product was seized upon for comparatively cheap and large hand-copies, editions of ancient authors, for Western Europe was hungry for learning; these editions stimulated a demand for mechanical reproductions; and printing was invented simultaneously about the middle of the fifteenth century by Coster, by

Gutenberg and doubtless by a half dozen others. A hundred years seems a long time, according to our twentieth century standards of rapid progress; but considering that mankind had existed endless centuries without printing, its invention within a single century after the discovery of a cheap material for multiple reproduction is an admirable achievement.

Within fifteen years after the first press was erected, hundreds of others were set up all over Europe, and over ten thousand standard works by ancient and modern authors had been printed, including all the known classics and hundreds of editions of the Bible. In 1505 the first newspaper appeared and actually contained news from Brazil.

Just as paper, which appears to be the accessory, made printing, which appears to be the fundamental invention, really possible, so the pneumatic tire, the accessory, made the automobile really possible. We cannot imagine the wide use of the automobile as we conceive it today—a vehicle of small-unit transportation—to carry us in speed and comfort over the highways—without the pneumatic tire, which seems at first glance to be nothing but a minor part of the equipment.

It is only thirty-two years since James Dunlop, in Dublin, made the first pneumatic tire, and where before there were perhaps a dozen automobiles in the world, there now are some 15,000,000. Dunlop was not looking for something on which to build the structure of the automobile industry—he wanted something to put on his invalid mother's wheeled chair, to make the old lady more comfortable when she took the air. As an example of the frequent thoroughness of pioneers it should be stated that his original tire was substantially as we know it today—an inner-tude, and a casing with a straight bead.

The automobile had its beginning as soon as the steam engine was invented —over a hundred years before the Dunlop invention appeared. Earnest engineers struggled to adapt it to individual road transportation, but without the pneumatic tire it was not serviceable enough to withstand the legislative pressure which put it on rails. It is interesting to speculate whether the railroad would ever have come if the pneumatic tire had been invented before mechanical power. —*Imperial Type Metal Magazine.*

America has furnished to the world the character of Washington. And if our American institutions had done nothing else, that alone would have entitled them to the respect of mankind.
—*Daniel Webster.*

MILITARY NOTES

furnished by

THE MILITARY INTELLIGENCE DIVISION, G. S.

Argentina

TRAINING OF DOGS FOR WAR.—That Argentina as well as Japan is interested in utilizing the services of dogs for communication purposes in war is shown by a recent report that:—

Sixty-six dogs to be used for military purposes have arrived in Buenos Aires from Brussels, where they were purchased by General Maglione, of the Argentine Army, during a recent trip to Europe. The animals belong to two breeds known as Malinois and Groneandal. They are said to display particular qualities of courage and intelligence, to which is added a keen sense of smell. All the dogs have been taken to the Military School at El Palomar, where they will undergo a special course of training by a man who during the war prepared quite a number of dogs to carry messages on the battlefield and between the different lines of attack.

China

REORGANIZATION OF FENGTIEN (MANCHURIAN) ARMY.—Following the fighting of the fall of 1924 Marshal Chang Tso-lin decided to reorganize his armies along the most modern lines using a combination of European and American systems. His purpose was two-fold, (a) to make each unit practically independent, thereby allowing for greater mobility and facility in administration, and (b) to promote many officers who had shown remarkable ability during the recent campaign by giving them added responsibility.

In December, 1924, an Army Reorganization Bureau was constituted at General Headquarters in Mukden and General Chang Hsueh-liang (the youthful son of Marshal Chang Tso-lin) was placed in direct command. As a result of three months' work of this Bureau, on March 27, 1925, a General Order was issued giving the following outline of the "Armies of the North East."

There are 16 divisions of infantry, 2 divisions of cavalry and 2 artillery brigades.

Infantry Division.

Each of the 16 infantry divisions is organized as follows under the command of a major general (three gold stars on a field of gold epaulets).

(a) Two brigades each commanded by a brigadier general totaling 5400 officers and men each.

(b) Three regiments in each brigade, each regiment commanded by a colonel and totaling 1800 officers and men per regiment.

(c) Three battalions in each regiment, each battalion commanded by a major and totaling 600 officers and men per battalion.

(d) Four companies in each battalion each company commanded by a captain and totaling 150 officers and men per company.

(e) Three platoons in each company. One first lieutenant and two second lieutenants command the three platoons. There are noncommissioned officers, usually one sergeant and two corporals to every two squads, one squad totaling eight men.

Auxiliary Regiment (Inf.) Units.

Each regiment (Inf.) has attached to it:

(a) One machine-gun company of six guns and totaling 40 officers and men.

(b) One trench mortar company of six 3-inch Sutton Mortars and totaling 100 officers and men.

(c) One special battalion including pioneers, engineers, sanitary and hospital units, and replacements, 700 officers and men.

Total Serength Infantry Regiment.

It will be seen therefore that the total strength of each division of infantry is 11,640 officers and men and that the total strength of 16 divisions of infantry is 186,240 officers and men.

Cavalry Division.

Each of the two divisions of cavalry is organized as follows under the command of a major general. The total strength of each division is 3200 officers and men.

(a) Two brigades each commanded by a brigadier general totaling 1600 officers and men.

(b) Two regiments in each brigade each commanded by a colonel totaling 800 officers and men each.

(c) Four squadrons in each regiment each commanded by a major and totaling 200 officers and men each.

(d) Three troops in each company each commanded by a captain and totaling 70 officers and men each.

(e) Three platoons in each squadron each under the command of a lieutenant.

Artillery Brigade.

Each of the two artillery brigades is organized as follows under the command of a brigadier general. The total strength of each artillery brigade is 2700 officers and men and 108 field guns.

(a) Three regiments in each brigade each commanded by a colonel and totaling 900 officers and men and 36 guns.

(b) Three battalions to each regiment commanded by a major and totaling 300 officers and men and 12 guns each.

(c) Three batteries in each battalion each commanded by a captain and totaling 100 officers and men and four guns.

(d) Two sections in each battery commanded by one first lieutenant and two second lieutenants, two guns each.

Engineers.

There is one regiment of engineers under the command of a colonel and divided into five battalions each commanded by a major. There are 600 officers and men in each battalion or a total of 3000 in all.

Recapitulation.

16 divisions,	infantry,	11,640 each	186,240
2 divisions,	cavalry,	3,200 each	6,400
2 brigades,	artillery,	2,700 each	5,400
1 regiment,	engineers,		3,000
		Total	201,040

Hungary

MILITARY ACADEMY.—The military school from which the Hungarian Army receives its commissioned officers of the lowest grade is the Royal Hungarian Honved Ludovica Academy.

This academy is organized similarly to the United States Military Academy, having one battalion of four companies, with a total of 500 cadets, and has a four-year system, which is also comparable to West Point. The graduating class furnishes cadet officers for all companies.

All members of the faculty and instructors are officers of the Hungarian Army. Instruction is given in practical training, military and allied sciences, chemistry, mathematics, etc., on about the same scale as the U. S. M. A.

The graduates are assigned as second lieutenants to infantry, cavalry, or field artillery. They have to obligate themselves to twenty years' service upon graduation, although they have the option of refunding to the Government the amount expended for their four years' instruction. This, however, is almost unknown, since practically every graduate enters the army.

As at present equipped, this military academy can furnish sufficient young officers, well-educated and well-disciplined, to replace all vacancies in the Hungarian Army.

Italy

GENERAL STAFFS OF DEFENSE FORCES.—Since the assumption of the portfolios of the Minister of War, Navy and Aviation, by Premier Mussolini, several changes have occurred amongst the officers holding the positions of Chief of Staff of the three services.

The new Chief of Staff, General Staff of the Army is General Badoglio with General Grazioli as Assistant Chief of Staff.

Vice Admiral Acton and Captain Cantu are, respectively, Chief and Assistant Chief of Staff of the Navy.

For aeronautics, General Piccio is Chief of Staff with Lieutenant Colonel Cassone as Assistant Chief.

The decree for the creation of a general staff for the Air Service was signed by the King on May 7th last. General Piccio was formerly general commander of the G. H. Q. Military Air Service and later Italian Air Attache at Paris. He is an Italian ace who was promoted three times during the war for exceptionally meritorious service. Recent reports from Italy are to the effect that the Ministry of Finance has approved the immediate increase of ninety million lire* in the 1925-26 aviation budget in view of the planned recorganization of the Air Service. The present budget amounts to 449 million lire and with this new increase will total 539 million.

In presenting the bill covering the Supreme Command of the Army to the Senate, Premier Mussolini stated in part:

* The lire is at present the equivalent of approximately 3.7 cents.

"The Bill therefore determines the activities of the Higher military authorities.

"It institutes the Chief of General Staff as the person who will provide for the organization of the land forces, for the preparation for war, and for the military subdivisioning of the territory of the State.

"Inasmuch as there must be only one man to preside over the technical military preparation, only one to draw up the general plans for war operations, the Chief of General Staff will outline for the Chiefs of Staffs of the Navy and Air Service also the general plans for the cooperation of the Air Service and Navy in attaining a unity of purpose.

"This means a return, amplified according to the increased exigencies of the times and to the experience of the World War, to the appointment of Chief of General Staff by which the Army, through the political vicissitudes of our recent history, achieved the unity of Italy and the triumph of Vittorio Veneto.

"From the Bill it is clear that the Chief of General Staff is vested with the necessary authority so that, while directly under the Ministry of War, he may develop activities of a technical character to the end of securing in the military provisions, uniformity of trend without discontinuity and without venturing on too radical and consequently dangerous changes.

"Hence, the Chief of General Staff may, if necessary, avail himself of the competence of the senior military authorities forming the advisory assembly known as the Council of the Army.

"Where questions of exceptional importance are concerned, the Chief of General Staff may consult with the present Marshals of Italy and the Grand Admiral as authorities who, because of their vast experience and personal value, can contribute efficiently to the solution of the most arduous military problems.

"The purposes of the Bill are substantially the following:

"(a) Unity of responsibility and of execution where technical provisions appertaining to the Army are concerned.

"(b) Continuity of technical trend with respect to such provisions.

"(c) Coordination of the general defensive organization of the State—the different forces retaining the necessary independence of technical preparation and of employment—and coordination of eventual war operations."

Siam

Siamese Army Maneuvers.—"Elaborate arrangements were made by the military authorities for the Army Maneuvers held this year near Ayudhya from March 10th to the 18th.

"Approximately 20,000 troops were employed in the maneuvers, comprising four divisions of the army, all coming from northern Siam. The men of these divisions were strong and healthy, and those assigned to camp duty were well trained in camp sanitation and the bivouacs were clean and orderly. All of the enlisted men were barefoot, and their feet were tough and thick, and rough ground had no effect on them.

"The field of operation consisted of rough paddy land and swampy marshes extremely difficult to pass.

"The infantry of the Siamese Army is equipped with the Japanese Arisaka rifle (1901) 8-mm. caliber.

"The artillery possessed by the Siamese Army is the type French 75-mm. Japanese make with somewhat shorter barrel than those used by the French. They have twelve batteries of four guns each.

"There were thirty-five planes taking part in the maneuvers.

"They have an excellent corps of aviators very well trained, and it is evident Siam bases her defense on aviation.

"The maneuvers lasted seven days. The soldiers stood their test wonderfully. Their hours of duty being from 5 a. m. to 8 p. m. each day.

"The army is trained entirely by Siamese, no foreign instructors being employed. Many of the officers have received military training in Europe."

Spain

Military Decorations.—New regulations have recently been promulgated in Madrid covering the granting of decorations to members of the Army and Navy.

The cross of "Maria Cristina" which was discontinued by the law dated June 29, 1919, is reinstated. A new decoration "Medalla Militar" (Military Medal) bicolor, is established to reward meritorious services in connection with military operations, rendered without actual combat against the enemy.

A list of military decorations now existing, follows:

Name of Decoration	*When Created*	*To Whom Awarded*	*Charater of Services Justifying Award*	*Extra Pay*
Cross of Military Merit, distinctive color, red.	December 30, 1889	Officers, enlisted, and civilians cooperating with military forces.	Individual merit directly influencing the success of a military operation.	No pay for officers. Enlisted may have a pension from ptas.* 12.50 to ptas. 25.-a month, during five years, or for life.
Cross of "Maria Cristina."	January 30, 1890. Discontinued June 29, 1919. Reinstated Mar. 16, 1925.	Officers and Enlisted.	Very distinguished individual merit. Conditions similar to those required for promotion.	Pension ranging from ptas. 750.00 to 3,750 ptas. a year for officers. From 500 to 675 ptas. for enlisted. Duration of pension, five years.
Military Medal	June 29, 1918	Officers and Enlisted.	Remarkable deeds facing the enemy.	No pension.
Cross of "San Fernando"	June 29, 1918	Officers and Enlisted.	Very exceptional heroic deeds or feats.	*With laurels*: from 1500 to 7500 ptas. a year for officers. From 1000 to 1250 ptas. for enlisted. *Plain*: from 300 to 1500 ptas. a year for officers. From 200 to 250 for enlisted.
Medal of suffering for the Country.	July 7, 1921	Officers and Enlisted.	Awarded to those wounded and captured in meritorious instances.	That of war prisoners, without pension; for wounded: officers, from 500 to 10,000.
Cross of Military Merit, bicolor.	July 7, 1921	Officers and Enlisted.	Meritorious war services, not while in active combat.	No pension.

* The peseta is at present the equivalent of approximately 14.50 cents.

Besides the foregoing crosses and medals, there exist, (a), the award of citation of "distinguished" in the General Order of the Army, in case of services which justify it (to be entered on the "record of service" or "efficiency report"); and (b), promotion to the next higher grade for war merit. Instead of promotion to the higher grade, the Cross of "Maria Cristina" or that of Military Merit, with red distintive color, may be awarded.

Collective awards may be granted to military Units.

Commanding Generals are authorized to grant all awards for enlisted personnel including promotion up to a warrant officer on the field of action, without previous proposal.

COAST ARTILLERY BOARD NOTES

Communications relating to the development or improvement in methods or materiel for the Coast Artillery will be welcome from any member of the Corps or of the service at large. These communications, with models or drawings of devices proposed, may be sent direct to the Coast Artillery Board, Fort Monroe, Virginia, and will receive careful consideration.—R. S. ABERNETHY, *Colonel, C. A. C., President Coast Artillery Board.*

New Projects Initiated During the Month of June

Project No. 355, Allowance of Canvas Paulins.—A letter from the Quartermaster General, referred by the Chief of Coast Artillery for remark and recommendation of the Coast Artillery Board with a view to standardization of sizes. The Board has requested the views of the Commanding Officers of the 12th, 61st, 51st and 52d Coast Artillery on the subject.

Project No. 356, Illuminating Projectiles for Coast Artillery (Star Shells).—This project was referred to the Board for study by the Chief of Coast Artillery. The Board recommended test of 6" star shells in harbor defense guns, and 3" star shells by Antiaircraft Artillery.

Project No. 357, Astronomic Theodolite for Artillery.—This is a device designed by Captain de Kraft-Helmhacker of the French Army for regulating artillery fire using a heavenly body as aiming point. After study of the device, the Board expressed the opinion that it gave no promise of practical value in connection with position finding and fire control for Coast Artillery.

Project No. 359, Modification of Gun Deflection Board, Model 1905.—This is a study by the Coast Artillery Board of a modified gun deflection board. This board was modified by the Battery Commander, Battery Warren, Fort Amador. The purpose of the modification is to extend the function of the deflection board so as to include azimuth difference corrections in indirect laying and arbitrary direction corrections in both direct and indirect laying.

Project No. 360, Test of Radio Equipment for D. B. Boats.—This is a test of a Type SCR-133 radio telegraph and telephone set to determine its suitability for use on distribution box boats.

Project No. 361, Mechanical Data Computer for Sound Ranging.—Captain J. W. Barker, C. A. C., and Captain P. D. Terry, C. A. C., while pursuing a course of instruction at Massachusetts Institute of Technology, made a study and prepared a thesis for their Master of Science degree on "The Application of Hyperbolic Functions to Sound Ranging." As a result of this investigation the above named officers conceived the idea of developing a mechanical computer for sound ranging. The Board has recommended that Captain Barker be requested to continue his studies along this line and to complete the development of a working model and that when completed the model be submitted to the Coast Artillery Board for test.

Project No. 362, Fire Control Communications System for Fort Storey.—The Coast Artillery Board, after study of the present contemplated system, recommended certain modifications, and also recommended that a searchlight project be instituted.

Project No. 363, Test of SCR-136 Radio Set.—Now undergoing test by the Coast Artillery Board.

Project No. 364, Lubrication Chart for 5-Ton Artillery Tractor.—Referred to Commanding Officer 51st Coast Artillery for remark and recommendation.

Project No. 365, Wearing of Personal Equipment.—A proposal to change the wearing of the canteen from the right to the left buttock in order to balance the weight of the pistol which is worn on the right hip. Under study.

Completed Projects

Project No. 222, Time Range and Azimuth Interpolating Device.—

I—History.

1. This project originated with the Coast Artillery Board, the object being to develop a more satisfactory solution for determining the time range (elevation) and azimuth relation than is given by the time range and azimuth boards used either in the plotting room or at the emplacement. The following is quoted from Project No. 220, Seacoast Artillery Firing:—

> "22. *Time Range (Elevation) and Time Azimuth Devices:* Prediction oftener than once in 30 seconds cannot be accomplished on manual plotting boards at present in use or adopted. However, it is desirable to provide a means for subdividing the range and azimuth predictions in order that accurate firing data may be available at the guns whenever they are ready to be fired. No thoroughly satisfactory means for subdividing these predictions has been prescribed. For fixed guns the time range relation board has been used for the interpolation of firing ranges together with "creeping" on the range drum of the gun. There is no serious objection to creeping, but the operations between procurement of a corrected range to the setforward point and the receipt of fire data by the range setters at the guns always have been cumbersome. It has been customary to plot the time range and time azimuth curve on the time range board and time azimuth board and then interpolate for the intermediate intervals. It is believed that a more satisfactory means for handling the time range and time azimuth relation can be devised and the Coast Artillery Board is studying this question in Coast Artillery Board Project No. 222, "Time Range and Time Azimuth Interpolating Devices." The Time Range and Time Azimuth Spirals described in Coast Artillery Board Project No. 75, "Fire Control System for 155-mm. G. F. P. Guns," and the use of proportional dividers in connection with the elevation board (Percentage Corrector) and the Deflection Board as described in Coast Artillery Board Project No. 117, "Fire Control Methods for Mortars" are both satisfactory. It is believed, however, that it may be feasible to develop means whereby the time range relation may be taken directly from the Percentage Corrector (Elevation Board) and the time azimuth relation directly from the deflection Board."

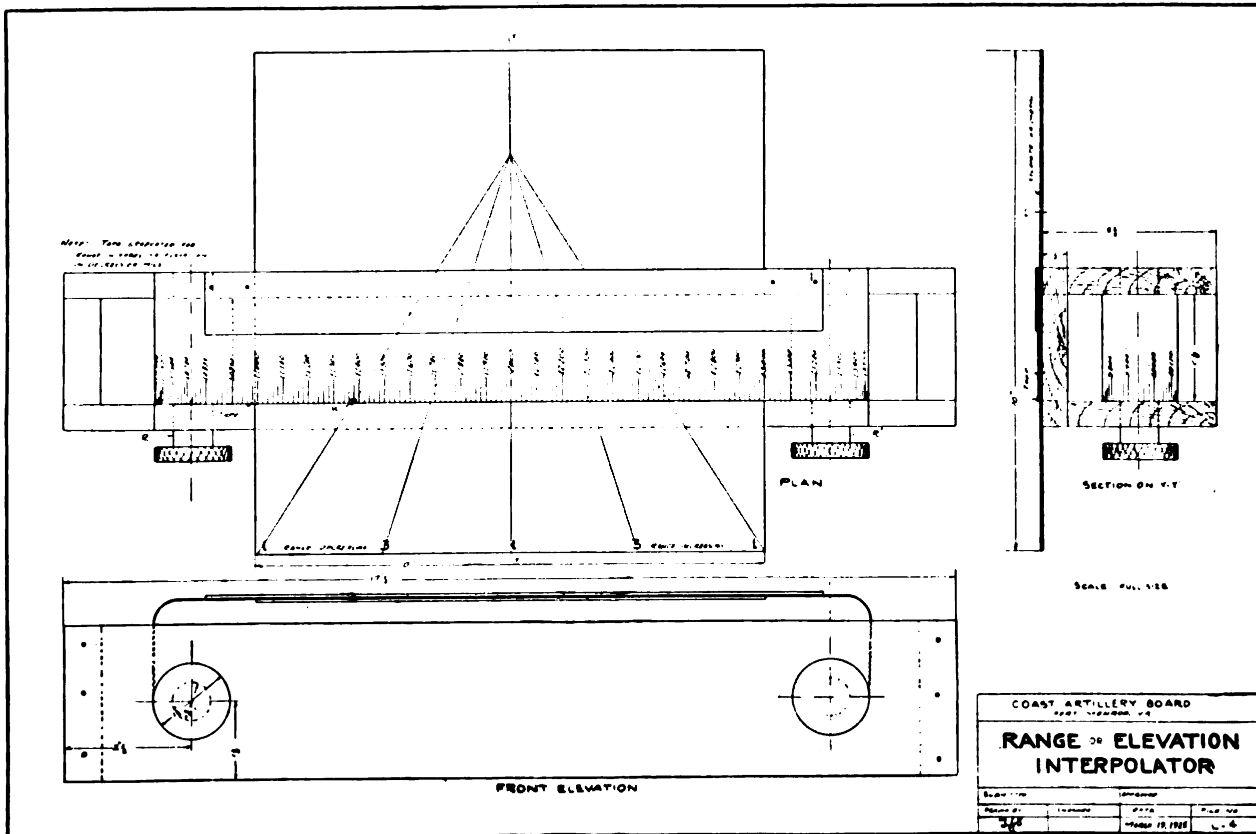

PLAN
SECTION ON Y-Y
SCALE FULL SIZE
FRONT ELEVATION
COAST ARTILLERY BOARD
RANGE OR ELEVATION
INTERPOLATOR

FIG. 1

II—Discussion.

2. The Coast Artillery Board incorporated a time azimuth relation device in the deflection boards reported on in Projects No. 316 and 87. These devices were given a thorough service test and proved very satisfactory so that the Coast Artillery Board believes the time azimuth relation problem is settled in connection with the proposed universal deflection board.

3. It was desired to apply a device similar to the splitter on the deflection board to the percentage corrector for determining interpolated or extrapolated ranges and elevations, but this could not be done quite as simply as on the deflection board. The reason for this is that for targets moving at 1200 yards per minute a splitter in connection with the logarithmic scale on the percentage corrector could not meet the conditions of maximum travel during a predicting interval. After considerable study it was decided that a simple small device carrying a tape on rollers and provided with a splitter similar to that on the deflection board (C A. B. Project No. 87) could be attached to the percentage corrector for determining the time range or elevation relation. The Coast Artillery Board devised such a device which is called the "Range or Elevation Interpolater." This device can be attached to the percentage corrector *and necessitates no changes in that device* as the percentage corrector has a slot on the side through which the xylonite or metal splitter of the range interpolator may pass. This slot is shown at "A" on Coast Artillery Board Drawing C-82-A attached hereto.

III—Description.

4. The range or elevation interpolator consists of a wooden frame having rollers R and R′ which carry a cloth blue-print range or elevation scale, as shown in Figure 1. The top of the interpolator is made into a guide for the xylonite, metal or pasteboard interpolating sheet and carries on it the reading lines marked 1 and 3. The xylonite sheet is free to move in or out and the cloth tape moves over the xylonite sheet. For use in making interpolated and extrapolated readings from the tape a small rider K is used. When the interpolator is manufactured at a post this rider may be an ordinary metal paper clip.

5. The cloth tapes are to be furnished by the Coast Artillery Board, the selection and arrangement of suitable scales being dependent upon particular armament with which the interpolator is to be used.

6. The splitter shown in Figure 1 is made of xylonite and has interpolating lines for 15 second intervals on one side. In arsenal construction it is believed the splitter should be of metal and have interpolating lines on one side as shown in Figure 1, but the reverse side to be covered with some material which would permit a battery commander to draw on it interpolating lines for any desired intervals as 5 or 10 seconds.

7. *Operation.*

a. The interpolator should be attached to the percentage corrector on the side opposite the correction scales.

b. The operator of the interpolator wears a headset and has direct telephone communication with the guns.

c. On the basis of 15 second intervals it will be found convenient to arrange the Time Interval system to give 3 taps of the bell each 30 seconds and 1 tap at the intermediate of 15 second interval.

d. The reading lines on the interpolator are numbered 1 and 3 and the side of the interpolator for use in determining proper interpolated ranges is indicated

by the notation "range decreasing" and "range increasing." Data read under the central line is sent out as soon as possible under 1 bell and are good for firing on 3 bells; data read under proper line 3 are sent out as soon as possible after 3 bells and are good for firing on 1 bell.

e. On 1 bell or as soon as available after 1 bell the interpolator operator reads in his telephone the data indicated by the read pointer of the percentage corrector. He moves the interpolator tape so the data indicated by the read pointer of the percentage corrector are indicated on the interpolator by the central line 1 and places the rider K on the tape at this point. Suppose the reading is 9600. On the next "one" bell or as soon as possible thereafter, the interpolator operator reads into his telephone the new data indicated by the read pointer of the percentage corrector and moves the interpolating tape to indicate the new data under the central line "1." Suppose the reading is 9200. The rider K will now have been displaced to the right. The xylonite sheet is moved in or out until the diagonal line 1 intersects the index of the rider, and the rider K is then moved back to the central line 1. The diagonal line 3 for increasing range indicates the proper data to be telephoned the guns on 3 bells and is good for firing on 1 bell. These operations are continued, the rider K always being brought back to the central line as soon as the setting of the diagonal line on the xylonite sheet has been made.

f. Should the operator of the percentage corrector fail to furnish any particular corrected range or elevation after the second, approximate corrected ranges or elevations may be predicted on the interpolator by keeping the xylonite sheet stationary moving the tape to the right or left as the case may be until the rider K again coincides with the proper diagonal line 1, reading predicted corrected ranges or elevations under central line 1 and proper diagonal line 3 and returning K to its position in coincidence with central line 1.

g. Should it be desired to lay the gun in elevation or range for times between the 15 and 30 second data, resort may be had to "creeping" on the range drum or the operator of the interpolator may be taught to estimate readings synchronizing them with a stop watch so as to send out practically continuous ranges or elevations. If desired, reading lines for 5 or 10 second intervals may be placed on the reverse side of the xylonite sheet and interpolations made as described above. (See paragraph 6).

8. *a.* Percentage correctors are being manufactured at Frankford Arsenal. It is considered very desirable to have five range or elevation interpolators made at the arsenal and attached to the percentage correctors so that both devices can be given conclusive service tests.

b. A model of the proposed range or elevation interpolator is available for shipment by mail to Frankford Arsenal. If arsenal construction closely follows the model, except as suggested in paragraph 6 above, it is believed the device will be quite satisfactory for service tests and will be inexpensive. It is understood that the percentage corrector costs approximately $40.00 each in lots of five and since the range interpolator is of much simpler construction the cost should be much less than that of the percentage corrector.

IV—Conclusions.

9. *a.* That the time azimuth relation device included in the deflection board proposed in C. A. B. Project No. 87 is a satisfactory solution of the time azimuth relation problem in connection with present fire control devices.

b. That the range or elevation interpolator described above offers a sufficiently promising solution of the time range relation problem to justify the manu-

facture of five such devices for service tests in connection with the five percentage correctors now being manufactured at Frankford Arsenal.

V—RECOMMENDATIONS.

10. *a.* That five range or elevation interpolators similar to the one shown in Figure 1, but subject to the suggestion made in paragraph 6 above, be manufactured and attached to the percentage correctors now being made at Frankford Arsenal.

b. That authority be granted to mail a model of the time range elevation interpolating device to Frankford Arsenal for the consideration of that arsenal.

c. That the Coast Artillery Board be authorized to furnish drawings and tapes for the Range or Elevation Interpolator whenever drawings of the percentage corrector are furnished organizations, and that Regular Army Organizations be authorized to use the Range or Elevation Interpolator.

VI—ACTION BY THE CHIEF OF COAST ARTILLERY.

First Indorsement

War Department, O. C. C. A., April 7, 1925.—To Chief of Ordnance:

1. The recommendations of the Coast Artillery Board contained in paragraphs 10-*b* and 10-*c* of the enclosed Project No. 222 are concurred in. The necessary steps will be taken by this office to put these recommendations into effect.

2. With reference to the recommendation contained in paragraph 10-*a* of the above project, information is desired as to the cost of the proposed device and the feasibility of adding this device to the five percentage correctors now under manufacture.

Strategy's object is to bring every available man to the battlefield, and place the army in a most favorable position to strike a deadly blow. The aim of tactics is to maneuver and handle the troops in the battle itself.—*History of Tactics, by A. F. Becke.*

BOOK REVIEWS

A Study of War. By Admiral Sir Reginald Custance. Houghton, Mifflin Co., Boston. 6" x 9". 214 pp. $3.50.

The object of this work, as stated in the preface, is "to remove the vagueness and ambiguity in which the theory of war is usually enveloped, and by so doing to explain the cause of the difference between the political and military points of view, and in some degree to reconcile them."

In view of the constant conflict and confusion of political and military aims in wars, one may incline to the belief that something very difficult is undertaken, but one needs read only a few chapters to become confident the aim will be realized.

The author points out that in considering the national aim in war he has substituted the British doctrine of the "will to security" for the German "will to power." Accordingly the reciprocal, national or political object in war is defined as: "Security for every questioned right, every threatened interest, and the State itself including its political system and territory."

In a later chapter it is stated: that "the military aim of each side is to destroy in battle, or to neutralize the action of the opposing armed force while sparing its own"; that "these are the primary military aims"; and that "as a contributing or secondary aim, during the interval * * * before the achievement of primary aims, each side may seek to weaken the armed force of its opponent, and to strengthen its own by impairing or increasing as the case may be the material resources and moral support upon which those forces depend." From this is derived the definition of the *whole* military aim of each side, i. e.: "To destroy in battle, or to neutralize, and to weaken the opposing armed force, including its directing will, while sparing and strengthening its own."

But a link is missing from the chain, in the failure to point out specifically that the national aim can never be realized except in consequence of the accomplishment of the military aim and that attempts to realize the political aim independently of the military aim must necessarily fail. It is true this is implied and may be deduced from the historical illustrations, but in the opinion of the reviewer, not even clear comprehension of the respective aims is more important to the statesman or the fighting man than definite recognition of this relation.

The author proceeds by illustration to show that the military aim may be accomplished by the destruction of the hostile armed force in battle or by its neutralization through "either threatening battle or evading battle or postponing battle."

Operations are briefly and clearly described and aptly chosen to illustrate the principles. In the course of his study the writer deduces that "to disarm an enemy who possesses both a navy and an army, two battles must be fought, the

one at sea, the other on land" and that "a navy alone is not a threat to the independence of a Continental State which possesses an army even if the State has no navy but that an army alone is such a threat to an island state whether that state possesses a navy or not." He fails to follow out his deduction to its conclusion, that, as a rule, final decision in a great war is obtained by the destruction of the hostile land force. It seems a characteristic of English writers to ignore the fact that Germany very nearly won the World War without defeating the British Navy.

The chapter on the relations between the Navy, Army and "Aery" will be found particularly interesting in its bearing on the present agitation for a separate air force for the United States. The writer concludes that air superiority will not be decisive, and that the air force should form integral parts of the Army and Navy.

The relations between the national object and military aim, in the view of Admiral Custance "are covered by the word *strategy* which may be defined thus: It is the province of strategy to attain the national object through the complete, partial or threatened achievement of the military aim under the existing political, economic and military conditions."

This definition is interesting but will not fit in with the ordinary conception of strategy as the adaptation of tactical operations to the attainment of the military aim. For example, Grant's strategy in 1865 was directed to the destruction of the Confederate armies and did not concern itself with national or political objects.

The reviewer does not agree with the *London Times* that this is a "notable contribution to naval literature" but believes this text is a notable study of war on land, on sea, and in the air, and the lessons taught invaluable to sailor, soldier, or statesman.—R. S. A.

Current Problems in Citizenship. By W. B. Munroe. The MacMillan Co., N. Y., 1924. $5\frac{1}{4}'' \times 7\frac{1}{2}''$. 541 pp. $1.80.

This book was written by the Professor of Municipal Government in Harvard University. He has reviewed his work in the preface as follows: "This book endeavors to explain, in concise form and simple language, some of the current problems with which every well-informed American citizen ought to be familiar. The term current problems is used in a broad sense, however, and the discussions are by no means restricted to topics which figure in the headlines of the daily newspapers. The latter are, for the most part, only the outcroppings of forces which are at work beneath the surface of our political, social, and economic life. Many problems of citizenship receive very little public discussion; yet they remain current over a long period of years and make their various phases manifest, one after another. The real nature of a current problem is frequently related to its origin, and for this origin we must sometimes go a long way back. The social studies cannot be entirely dissociated from history; their relations are too intimate.

"The author has tried to present problems, not to solve them. No problem of democracy, worthy of the name, can be solved by merely applying a rule or principle. On the other hand this book devotes considerable attention to the various solutions which have been proposed from all quarters and examines the merits of these proposals—when they have any merits. The idea, in short, is to let the reader form his own opinions but to afford him such guidance that he will be able to do it intelligently.

"At the end of each problem there is a reference to some more comprehensive discussion of the matter, or to a source from which additional information may be obtained. It has not been deemed necessary to cumber the pages with long bibliographies which can be found in any of the regular textbooks. Nor has it been deemed essential to insert lists of questions. Every problem is itself a question, indeed a series of questions, as will readily appear from a glance at the marginal notes."

Current Problems in Citizenship satisfies the above in a most interesting and instructive manner. Its conciseness enables a wide field to be covered in thirty-two chapters which have been grouped under the three headings of Man and His Environment, Problems in the Organization and Work of Government, and Problems relating to the Civic Activities—Economic, Social, and International.—H. B. H.

Our Capital on the Potomac. By Helen Nicolay, The Century Co., New York, 1924. 6¼"x9¼". 544 pp. with index. Profusely illustrated. Price $5.00.

In this day of a rapidly increasing literature on places, it is refreshing to find a volume that so distinctly is neither a guide book nor a sop to civic pride. Miss Nicolay has achieved a difficult task, she has written a most interesting tale of "Our Capital on the Potomac." The author already is known to us from her "Personal Traits of Abraham Lincoln" and "Our Nation in the Building," and is well qualified by association and study to treat of this subject. From events leading to the selection of the site of the District, the story leads us through the life of the city down to the period of World War demobilization. It is a story of life, not merely of a place. The place forms a background and is well cared for in the tales of living events. It is the latter that compel attention and that have made this such an entertaining work. The establishment and growth of the city are depicted amid the accounts of the doings of the interesting people inhabiting it. Intimate views of the presidents and other national characters are portrayed. In short, Miss Nicolay has contributed a history of the development of Washington that is full of information, a history that is of absorbing interest, and altogether a most readable book.—C. D. Y. O.

Bird Islands of Peru. By Robert Cushman Murphy. G. P. Putnam's Sons, New York, 1925. 6½"x 9½". XX + 362 pp. Illustrated. Price $5.00.

This book is an account of Dr. Murphy's expedition to the islands of the Peruvian coast from September, 1919, to February, 1920, under the auspices of the Brooklyn Museum. One of the objects of the expedition was to investigate the oceanic conditions responsible for the peculiar zoological conditions existing in that little known part of the world. This book explains, in popular language, the profound effect which the up-welling cold waters of the Humboldt Current have upon the climate of coastal Peru and upon the kind and quantity of fish which frequent the locality in such vast schools. Where there are plenty of fish there one expects to find an abundance of sea-fowl and this is certainly the case among the islets which fringe the coast of Peru. The myriads of gannats and other sea birds (many of which seem to be out of their usual habitat) that subsist on the fish of the Humboldt Current have rendered possible the great guano industry of Peru.

The ups and downs of this industry are treated in some detail and from thoroughly reliable sources, as are also the present day more scientific methods of exploitation used by the Peruvian government. Probably the most interesting parts of the book to the casual reader are the descriptions and the illustrations

which give one an idea of the sheer *numbers* of these guano-birds which completely and solidly cover areas of several square miles of the barren islands, so that the latter, from a distance, seem to have changed complexion from a gleaming white to a sombre black.

The formation of the book is excellent and the numerous illustrations, while not always contiguous to their related printed matter, are well selected.—P. D. B.

Daedalus or Science and the Future. By J. B. S. Haldane. E. P. Dutton and Company, New York, 1924. 93 pp. Price $1.00.

H. G. Wells, that versatile Englishman, in 1902 wrote in a book called "Anticipations" that in 1950 there would be heavier than air flying machines capable of practical use in war. Mr. Haldane, a scientist at Cambridge University, is the author of "Daedalus or Science and the Future." He promises in the beginning to make no prophesies rasher than this one.

The author states: "It is a fairly safe prophesy that in fifty years light will cost about a fiftieth of its present price and there will be no more night in our cities." He does not think waterpower a probable substitute for coal and oil. "Personally, I think four hundred years hence the power question in England may be solved somewhat as follows: The country will be covered with rows of metallic windmills working electric motors which in their turn supply current at a very high voltage to great electric mains. At suitable distances, there will be great power stations where during windy weather the surplus power will be used for the electrolytic decomposition of water into oxygen and hydrogen."

He believes the future will see the utilization of low grade iron ores; the production of aluminum from clay which contains up to 24 per cent of that metal; the use of acid sodium phosphate as a stimulant which does not have the after-effects like those of alcohol; and the preparation of synthetic foods which will mean that agriculture will become a luxury.

These and many other prophecies make the book of interest to those who try to pierce the veil of the future.—W. W. I.

The History of the United States Army. By Major Wm. D. Ganoe. D. Appleton and Company, New York, 1924. 1 Volume, 609 pp., illustrated. $5.00.

History is "a systematic record of past events, especially of those in which man has taken part." And this is the first history of the United States Army which has been most important in the development of our country. This book gives chronologically the life of the United States Army; showing wherein progress was made and wherein there was lack of progress and even retrogression. The causes for success or failure of the Army throughout our existence as a nation are carefully analyzed and the conclusion is reached that the condition of the Army was greatly predicated on the intelligent interest manifested by the people through their representatives in Congress. Other influencing considerations, such as political influences in conduct of operations, are well covered.

It does not go into the tactical and strategical details of campaigns except to bring out all the advantages of training and good organization as opposed to the disadvantages incident to the untrained and poorly organized troops.

The chapter headings give a very good idea of its contents, thus: Drab Beginnings (1775-1776); The Army Learns to Walk and Run (1776-1777); The Army Finds Discipline and Success (1778-1781); The Army Flung Aside (1781-1811); The Army in Name (1812-1820); The Army Blazes the Trail (1821-1844);

The Army Wins and Widens the Boundaries (1845-1859); The Army Divides and Multiplies (1860-1865); The Army's Dark Ages (1865-1880); The Army's Renaissance, First Phase (1881-1896), Second Phase (1899-1916); Epilogue (1917-1923).

The book is a valuable source of information particularly as it contains many facts which have not been conveniently presented heretofore. Its arrangement is such that the activities and condition of the Army in any period can be readily ascertained. It also is useful in following the history of a particular organization.

It contains much that should be a part of every American's education and especially of those who are concerned with the organization, training and operations of any part of the Army.—C. F. M.

Radio for Everybody. By A. C. Lescarboura. Scientific American Publishing Co., N. Y., 1924. 5"x 7½". 358 pp. Cloth. Price $1.50.

This book contains the very latest in the theory and practice of radio communication expressed in a clear and interesting manner. It is full of pratical and helpful information for the layman who desires the essentials with a minimum of theory and a total absence of mathematics. The treatment of radio principles is hardly elementary enough for the beginner, who knows nothing of electricity or radio, but even he can fiud much of interest. It will be of great benefit to the average radio devotee who is eager to learn more about his set and other sets. It gives a brief history of broadcasting and the work at the studio; covers the underlying principles of all basic receiving sets and the modifications as sold on the market today, including the neutrodyne, superdyne, super-heterodyne and the rest of the "dyne" family; tells how to build your own set and how to buy a set; and covers vacuum tubes, radio and audio amplification, loud speakers, regeneration, static, and full description of parts. Also contains a dictionary of the most common terms employed in every-day radio work.

The book is profusely illustrated throughout with well selected drawings and pictures which greatly simplify the explanations.—E. R. C.

Head Hunters of the Amazon. By F. W. Up de Graff, with foreword by Kermit Roosevelt. Duffield and Co., New York. 337 pp. with illustrations. $5.00.

A seven year's Odessey. Mr. Up de Graff began his wanderings in 1894 and concluded them in 1901. During the interim he crossed the continent of South America and explored the upper reaches of some of the tributaries of the Amazon. This was practically unknown land, and his experiences there are indicative of the suffering man will undergo in his search for adventure or gold. Probably his is the only white party to participate in a head hunt and the gruesome rites subsequent thereto. He met every form of beast, reptile or pest in South America. He records anacondas of lengths unadmitted by other explorers and scientists, and thereon hangs a seemingly unending dispute, as mentioned by Mr. Roosevelt in his forword. Mr. Up de Graff modestly disclaims any literary or scientific ability, yet, to the reader, he fails completely to live up to his disclaimer. Interesting alike to the scientific or adventurous mind, the history is as readable as a novel. The easy style of expression, the sense of humor and the thrill of the adventures carry one through page after page. Mr. Up de Graff has a most pleasing personality which he carries to you in every paragraph of his narration. —B. F. H.

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THE COAST ARTILLERY JOURNAL

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A Five Foot Book Shelf for Coast Artillerymen

By Brigadier General R. E. Callan, *U. S. Army*

DURING the major portion of my tour of duty in the Phillippines (1915-1917), I was Assistant Chief of Staff and in charge of the Military Information Division. This Division contained a most interesting library of some 11,000 volumes peculiarly suited for reading in military subjects and Far East travel. I was struck by the interest that was taken by officers of all arms in the library and was continually prodded into the purchase of up-to-date books, particularly along military lines.

One thing that was outstanding in the search of many officers, was the desire to obtain some reasonable limit to the kind and number of books whose study would cover even generally their profession. This led me to the utilization of Dr. Eliot's idea of a five foot shelf. I established such a series of shelves at the entrance to the library commencing with one for Infantry officers. After consulting with many able officers of that branch, I placed together a series of books covering the technique and tactics of that branch graduating into the use of the combined arms and concluding with studies on war by some of the best European authorities. A notice was put on the shelf that any Infantry officer was always at liberty to take any book out of the shelf and have it replaced by some other book in the library or by one that I should purchase. The whole thing provoked considerable interest and discussion and finally resulted in a fairly stable shelf of books. I did the same thing for the other combat branches with the clear result that the more technical arms had too many scattered technical works and too few tactical treatises to make a valuable five foot shelf. Naturally this was particularly true of the Coast Artillery.

Shortly after coming to my present command* I was talking to my Plans and Training Officer, Capt. W. W. Irvine, C. A. C.,

* General Callan is at present Commanding General of the Third Coast Artillery District and Commandant of the Coast Artillery School.

about this matter and realizing that many of the deficiencies referred to above have been corrected since 1917, I suggested to him that he get up such a shelf for the Coast Artillery officers and advise and consult with the Coast Artillery School and the Coast Artillery Board in its preparation. This list is appended and is the result of much more labor on the part of the officers concerned than would be apparent at first glance.

There is at the present time a distinct demand by the officers of the Coast Artillery Corps for guidance in their reading and study in order that they may perfect their knowledge as artillerymen and fit themselves for tactical command. Under the present policy of the War Department, only a few officers will attend all the service schools and many officers will not take both the Battery Officers' Course and the Advanced Course of the C. A. School. The technical and tactical education of an officer is gained by experience, by attendance at service schools, and by individual study. The individual effort of those officers who do not attend the service schools should be stimulated in every way, and in particular by suggesting a series of books and pamphlets for their study. The collection of books listed in this article actually measures about four feet; it should be borne in mind that the selection does not represent the choice of any one officer; the assistant commandant, the directors, and instructors of the Coast Artillery School, the members of the Coast Artillery Board, and other officers have assisted.

It is improbable that many officers will desire to collect this list of books, except over a period of years. Obviously, a list can not be prepared which will meet the requirements of all grades. Requirements in grade vary with experience, service schools attended, etc. The officer just entering the army will not need books on tactics. He is concerned primarily with technique. The books listed on tactics will probably pass through several revised editions before he will desire to purchase them. On the other hand, the officer of from five to ten years' experience will wish to take up the tactics of his arm and at the same time keep up his interest in technique. Other officers, say those of twenty years' service, will be much concerned with tactics of all arms. Their study of technique will be diminished accordingly.

It is evident from a study of this bookshelf that a few texts need revision and that in some cases a compilation into one publication of several texts is desirable; for instance, the publication of a text book on Tactics for Seacoast Artillery. The several texts listed under the heading "Tactics, Seacoast Artillery," are not considered altogether satisfactory.

Some subjects that should be covered do not appear in the list. Most of these subjects will be covered by War Department training regulations and other publications. It was deemed best at the present time to omit references to subjects where satisfactory texts have not been printed.

Of the 139 training regulations, pamphlets, mimeographs, and books, 94 can be obtained from the War Department and 23 can be obtained at a small cost from the Command and General Staff School or the COAST ARTILLERY JOURNAL. While the 21 Coast Artillery School publications are not available for distribution, they can be obtained by loan from the Coast Artillery School library.

The younger officer should avoid going into the subject of tactics before becoming proficient in the technique of artillery. Tactical decisions will seldom be made by an officer of Coast Artillery below the grade of major, and tactical decisions of any officer will be of little value if he and his battery commanders are not thorough technicians. The coast artilleryman must know his gunnery and his materiel, if he is to render effective service in battle. The battery commander may have many qualities of leadership but if he is deficient in the technique of artillery it will avail him little.

The last quarter of a century has witnessed tremendous progress in fire against moving naval and aerial targets. However, many gunnery problems still need improved solutions, especially in fire against aerial targets. Most inventions and discoveries have been the result of a general advance in knowledge all along the line. Often inventions and discoveries have been made almost at the same time by several men. It is seldom that a single individual, unaided by the experience of others, makes remarkable strides in any kind of research. For this reason, if we are to solve the problems now facing us, it must be by united and progressive effort.

In addition to the needed improvement of technique to meet the different fire problems that the Coast Artillery officer must solve, there is a crying need for a great revival in seacoast artillery tactics. Such problems include the tactical principles underlying prompt action of coast cannon against warships, the tactical combinations or groupings of such cannon, the proper utilization of reinforcement artillery, both railway and tractor drawn, the emplacement of the latter classes of artillery out of support of fixed cannon, and the relation and organization of all classes of Coast Artillery to sector and sub-sector commanders. All of these questions are well worth rather intensive study by coast artillery field officers. The five foot book shelf can be strengthened particularly along these lines and it is hoped that many interested officers will come forward and present

their views on these matters both in their tactical exercises and in articles for the COAST ARTILLERY JOURNAL. The result of such studies in a few years could provide additions to the Coast Artillery five foot shelf that would be most valuable to all officers in the Corps.

COAST ARTILLERY

TACTICS

ANTIAIRCRAFT ARTILLERY

TR 435-30, Tactical Employment of Antiaircraft Artillery. War Department. 5 cents.

A Study of the Organization, Command, and Employment of Antiaircraft Artillery. Coast Artillery School.

ARTILLERY WITH LAND FORCES

Tactical employment of Railway Artillery. Coast Artillery School. This mimeograph, when approved will be published as TR 435-25. See also Notes on Railway Artillery, listed elsewhere.

TR 435-105, Tactical Employment F. A. War Department. 15 cents.

TR 435-155, Reconnaissance and Occupation of Position. War Department. 10 cents.

SEACOAST

TR 435-20, Emplacement and Tactical Employment of Coast Artillery in Harbor Defense. War Department. 5 cents.

Tactical Employment of Tractor Artillery in Coast Defense. Coast Artillery School.

Coast Artillery War Game (W. D. Doc. 540). War Department.

Joint Army and Navy Action in Coast Defense. War Department.

Notes on Seacoast Defense. Coast Artillery School. Confidential. Not available for distribution.

Naval Strategy and Tactics with Special Reference to Seacoast Fortifications. Coast Artillery School. Confidential. Also included in Notes in Seacoast Defense.

TECHNIQUE

FIRE CONTROL, POSITION FINDING, AND COMMUNICATIONS

TR 435-221, Fire Control and Position Finding. War Department. 10 cents.

Signal Corps Manual No. 8 (W. D. Doc. 483). War Department. Confidential.

Elementary Principles of Radio Telegraphy and Telephony (W. D. Doc. 1064). War Department. 10 cents.

The Principles Underlying Radio Communication (W. D. Doc. 1069). War Department. $1.00.

MATERIEL

Heavy Artillery Materiel, Parts I-VI. Coast Artillery Journal. $1.50.

Handbook of American Coast Artillery Materiel (W. D. Doc. 2042). War Department.

Military Motor Transportation. Coast Artillery Journal. $1.00.

Ordnance Pamphlets on Piece and Carriage of Battery to which Officer is Assigned. War Department. These pamphlets will all be published as TR.

Manual of Submarine Mines (W. D. Doc. 399). War Department. Confidential.

TR 310-20, Fire Control Instrument, Mobile Artillery. War Department. 10 cents.

Railway Artillery-Characteristics and Scope of Utility. Vol. I, only. War Department.

GUNNERY

Gunnery for Heavy Artillery, 1925. Coast Artillery School. This book will be published during 1925 as TR 435-280.
TR 435-210, Gunnery for Antiaircraft Machine Guns. War Department. 5 cents.
TR 435-160, Gunnery for Antiaircraft Artillery. War Department. 5 cents.
Antiaircraft Gunnery and Position Finding, 1925. Coast Artillery Journal. 75 cents.
Firing Tables. War Department.

ORIENTATION AND MAP READING

TR 435-325, Orientation for Heavy Artillery. War Department.
TR 190-5, May Reading. War Department. 5 cents.
TR 190-10, Conventional Signs. War Department. 5 cents.
Geodetic Surveying. (Mimeograph Eng. School.) Engineer School.
AR 100-5, Maps and Mapping. War Department. Will be published as TR 445-90.

ORGANIZATION AND TRAINING

ANTIAIRCRAFT

TR 435-75, Searchlight Battery. War Department. 5 cents.
TR 435-85, Machine Gun Battery. War Department. 5 cents.
TR 435-90, Gun Battery. War Department. 5 cents.
TR 435-95, Service Battery. War Department. 5 cents.
TR 435-98, Separate Battalion. War Department. 5 cents.
TR 435-105, Bn. Hq. & C. T. Machine Gun Battery. War Department. 5 cents.
TR 435-100, Bn. Hq. & C. T. Gun Battery. War Department. 5 cents.
TR 435-110, Gun Battalion. War Department. 5 cents.
TR 435-115, Hq. & Hq. Btry. A. A. Regt. War Department. 5 cents
TR 435-120, A. A. Regt. War Department. 5 cents.
TR 435-161, Identification of Aircraft. War Department. 5 cents.
TR 435-211, Machine Gun Marksmanship. War Department. 5 cents.
TR 310-136, Description, Operation, etc., of Mobile Searchlight. (Provisional.) War Department. (O. C. E. Mimeo.) Will probably be published as TR. This is a C. A. M. No. 6.
Antiaircraft Target Practice, and Searchlight Exercise. War Department. (O. C. C. A.)

HARBOR DEFENSE

TR 435-220, The Battery Command. War Department. 10 cents.
TR 435-290, The Fire Command. War Department. 5 cents.
TR 435-295, The Fort Command. War Department. 5 cents.
TR 435-300, The Coast Defense Command. War Department. 5 cents.
Tactical Use of Seachlights (Prov. TR 435-330). Coast Artillery School.
Type Programs and Schedules of Training Required within a Coast Defense Command upon Mobilization. War Department. (O. C. C. A.) This bulletin will later be issued as a TR.
Coast Artillery Definitions (Prov. TR 435-307). Coast Artillery School.
The Mine Command (Prov. TR 435-315). Coast Artillery School.
Headquarters Battery C. A. Regt. (TR 435-222). War Department. (O. C. C. A.) Distributed in mimeograph form.

RAILWAY ARTILLERY

Notes on Railway Artillery. Coast Artillery School. This text is a compilation covering to some extent technique and tactics.
The Battery Command, Railway Artillery (Prov. TR 435-225). Coast Artillery School. All provisional training regulations when approved will be published by the War Department as TR.

Battalion Railway Artillery (Prov. TR 435-170). Coast Artillery School.
Service Battery (Prov. TR 435-240). Coast Artillery School.
Regiment Railway Artillery (Prov. TR 435-175). Coast Artillery School.
Brigade Railway Artillery (Prov. TR 435-180). Coast Artillery School.

TRACTOR ARTILLERY

Battery Command Heavy Tractor Artillery (Prov. TR 435-185). Coast Artillery School.
Battalion Heavy Tractor Artillery (Prov. TR 435-189). Coast Artillery School.
Regiment Heavy Tractor Artillery (Prov. TR 435-190). Coast Artillery School.

TRENCH ARTILLERY

Training regulations are being prepared on this subject.

SOUND RANGING

Flash, Sound, and High Burst Ranging. Coast Artillery School. Four TR on SR have been prepared but not published.

GENERAL

TR 435-55, Analysis of Drill and Analysis and Rpt. of TP. War Department. 10 cents.
TR 435-56, The Schloming Film and Tangent Scale. War Department. 5 cents.
TR 435-310, Examination for Gunners. War Department. 5 cents.
Service of the Piece, TR for Armament to which Assigned. War Department. 5 cents.
Mine and Sub-mine Target Practice (Prov. TR 435-51). Coast Artillery School.
Tables of Organization for Coast Artillery Units. War Department.
Operation of a Coast Defense Meteorological Station. Coast Artillery School. A mimeograph.
TR 50-15, Instruction Dismounted without Arms. War Department. 5 cents.
TR 50-20, Instruction Dismounted with Rifle. War Department. 5 cents.
TR 20-25, Instruction with Bayonet. War Department. 5 cents.
TR 50-55, Instruction Dismounted with Pistol. War Department. 5 cents.
TR 50-90, Display of Equipment. War Department. 5 cents.
TR 75-85, The Motor Vehicle Operator. War Department. 5 cents.
TR 112-5, Outlines of First Aid for the Injured or Sick. War Department. 5 cents.
TR 113-5, Principles of Personal Hygiene. War Department. 5 cents.
TR 135-5, Ceremonies of Guard Mounting Foot Troops. War Department. 5 cents.
TR 150-5, Marksmanship, Rifle Individual. War Department. 5 cents.
TR 150-10, Marksmanship, General. War Department. 5 cents.
TR 150-30, Marksmanship, The Automatic Rifle. War Department. 10 cents.
TR 150-35, Marksmanship, The Machine Gun. War Department. 15 cents.
TR 185-5, Rigging. War Department. 5 cents.
TR 200-5, Scouting and Patrolling (Dismounted). War Department. 10 cents.
TR 310-50, Field Ranges. War Department. 15 cents.
TR 320-10, U. S. Rifle. War Department. 5 cents.
TR 320-15 Automatic Pistol. War Department. 5 cents.
TR 420-20, Dismounted Ceremonies. War Department. 5 cents.
TR 420-40, Drill and Combat Signals. War Department. 5 cents.
TR 420-45, Infantry General. War Department. 5 cents.
TR 420-50, Drill, The Rifle Squad, etc. War Department. 10 cents.
TR 420-60, Drill, The Infantry Battalion. War Department. 5 cents.
TR 420-80, Drill, The Infantry Regiment, etc. War Department. 5 cents.
TR 420-85, Extended Order, etc. War Department. 5 cents.

OTHER ARMS

General

TR 10-5, Doctrine, Principles and Methods. War Department. 5 cents.
Field Service Regulations, 1923 (W. D. Doc. 1120). War Department.
The Military Policy of the United States, Bulletin 1921. War Department. This title is listed as TR 15-5, not yet published.
Methods of Training, 1923. Command and General Staff School. 50 cents.
Tables of Organizations, Infantry and Cavalry Divisions. Command and General Staff School. 50 cents.
General Map of Gettysburg, 1924, 1″ = 5 miles. Command and General Staff School. 50 cents.
Topographical Map of Gettysburg—Antietam, 10 sheets. Command and General Staff School. 5 cents each. Mounted on Muslin, $3.00.
Geological Survey, 37 sheets. Command and General Staff School. 5 cents each.
Military Organization of U. S. Command and General Staff School. 15 cents.
Military Aid to Civil Powers. Command and General Staff School.
Military Protection (W. D. Doc. 882). War Department.
TR 160-5, Signal Communications, All Arms. War Department. 10 cents.
Rules for Land Warfare (W. D. Doc. 67). War Department.
Epitome of Upton's Military Policy (W. D. Doc. 505). War Department.
A Manual for Courts-Martial, U. S. Army. War Department.

Tactics and Technique of the Separate Branches

Tactics of Separate Branches, Vols. I and II. Command and General Staff School. 50 cents each.
Combat Orders, 1924. Command and General Staff School. 50 cents.
Solution of Map Problems, 1924. Command and General Staff School. 25 cents.
Field Fortifications. Command and General Staff School. 50 cents.
Tactical Principles and Decisions, Vols. I and II. Command and General Staff School. $5.00 (approx). Published in separate chapters loose leaf binders. Each chapter from 10 to 40 cents.
Command Staff and Logistics. Command and General Staff School. $1.50.
Notes on Combat Intelligence. Command and General Staff School. 50 cents.
Troop Leading, Vols. I and II. Command and General Staff School. 75 cents.
Tactical and Strategical Studies, The Corps Vol. I. Command and General Staff School. $1.00.
Tactical and Strategical Studies, Corps and Army, Vol. II. Command and General Staff School. $2.00.
Tactics and Technique of Artillery, Vols. I and II. Command and General Staff School. $1.50.
Tactics and Technique of Separate Branches, Cav. Command and General Staff School.
Tactical Employment of Machine Guns. Command and General Staff School.
TR 420-105, Combat Principles, The Rifle Squad. War Department. 10 cents.
TR 420-110, Combat Principles, The Rifle Section. War Department. 5 cents.
TR 420-115, Combat Principles, The Rifle Platoon. War Department. 10 cents.
TR 420-120, Combat Principles, The Rifle Company. War Department. 5 cents.
TR 420-125, Combat Principles, The Machine Gun Section. War Department. 5 cents.
TR 420-130, Combat Principles, The Machine Gun Platoon. War Department. 5 cents.
TR 420-135, Combat Principles, The Machine Gun Company. War Department. 5 cents.
TR 420-140, Combat Principles, Howitzer Company Squads. War Department. 5 cents.

TR 420-150, Combat Principles, Howitzer Company Platoons. War Department. 5 cents.
TR 420-155, Combat Principles, Howitzer Company. War Department. 5 cents.
TR 420-160, Combat Principles, The Infantry Battalion. War Department. 5 cents.
TR 420-170, Combat Principles, The Infantry Regiment. War Department. 5 cents.
TR 420-180, Combat Principles, The Service Company. War Department. 5 cents.
TR 420-185, Combat Principles, The Infantry Brigade. War Department. 5 cents.

Summary

COAST ARTILLERY:

Tactics, 11; Technique, 21; Organization and Training, 65; Sub Total, 97.

OTHER ARMS:

General, 15; Tactics and Technique, 27; Sub Total, 42; Grand Total, 139.

PUBLISHERS:

War Department, 94; Coast Artillery School, 221; Command and General Staff School, 20; Coast Artillery Journal, 3; Engineer School, 1.

NOTE: C. & G. S. S. books may be purchased through the COAST ARTILLERY JOURNAL.

CORRECTION

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September, 1925

The Third Coast Artillery

A Historical Sketch

By Major George Ruhlen, Jr., C. A. C.

THE Third Coast Artillery was organized July 1, 1924, under the provisions of General Orders No. 8, War Department, February 27, 1924, by reconstituting the former Third Regiment of United States Artillery which was broken up in 1901 when the artillery of the Army was formed into a corps. The companies of the Coast Artillery Corps constituting the Third Coast Artillery were batteries of the Third Regiment of Artillery, and all have been in existence since the respective dates of organizations as combat units.

C. A. C. Serial Designation 1901	*Designation in 3rd Regiment of Artillery (Organized 1821)*	*Battery Designation in 3rd Coast Artillery July 1st, 1924*	*Original Date of Organization*
25th Company	A	A	1812
26th Company	B	B	1794
27th Company	D	D	1794
28th Company	E	E	1821
31st Company	I	C	1812
34th Company	M	F	1847
35th Company	N	G	1899
36th Company	O	Hq. Btry.	1899

Batteries B and D are the oldest Coast Artillery batteries in the Army.

The artillery arm of the service has been in continuous existence since 1775, prior to the adoption of the Declaration of Independence. Artillery was present and participated in the Battle of Bunker Hill. There was a Third Regiment of Artillery in the Continental Army, which was disbanded at the close of the Revolution. During the War of 1812 one of the regiments of artillery was known as the Third Artillery and was commanded by Colonel Alexander Macomb, who afterwards became general in chief of the army. This regiment enjoyed a brief though highly distinguished career, serving like its revolu-

Note: General Wm. E. Birkhimer's historical sketch of the Third United States Artillery, published by the Military Service Institute in March, 1893, has been drawn upon freely for historical data pertaining to the Civil War and prior thereto. Reference to lettered batteries apply to the battery designations in the old Third Artillery. Batteries A, B, D, and E have retained their former designations.

tionary predecessor, from the first to last in the face of the enemy. In 1814 the regiments of artillery were formed into a Corps of Artillery composed of battalions and companies.

The history of the Third Regiment of the United States Artillery dated from the reorganization of the army pursuant to the Act of Congress approved March 2, 1821. This act reduced the military establishment and fixed the line of the army at four regiments of artillery and seven of infantry. The Third Regiment of Artillery was organized from the Corps of Artillery formed by the Act of March 30, 1814, from the Corps of Artillerists and Engineers organized in 1794, from the First Regiment of Artillery organized in 1802, and the Second and Third Regiments of the Artillery organized in 1812.

During the War of 1812, Battery A was engaged at Fort Oswego, N. Y., May 5-6, 1814, where on May 5th it repulsed the landing of British troops in small boats by a deadly artillery fire. Battery B was stationed at Fort Johnson, South Carolina, from 1812 to 1816. Battery D was stationed at Fort Nelson, Norfolk, Virginia, and was present during the British attack and repulse on the navy yard at that place June 22, 1813. Battery I (now C, 3d Coast Artillery) was stationed at Petersburg, Virginia, in 1812, and at Craney Island, Virginia, in 1815.

Among many distinguished officers who served with the Third Artillery were General W. K. Armistead, the first colonel of the regiment; Roger Jones, for many years Adjutant General of the Army; Albert E. Church, the honored Professor of Mathematics at West Point; Robert Anderson, the hero of Fort Sumter, was an officer of the regiment for thirty-two years; Erasmus D. Keyes; George G. Meade, the Union commander at Gettysburg; Thomas W. Sherman; Braxton Bragg, afterwards lieutenant-general in the Confederate service; Wm. T. Sherman; Stewart Van Vliet; Jubal A. Early; George H. Thomas; John F. Reynolds, who was killed while commanding his Corps on the first day of Gettysburg; E. O. C. Ord; Samuel G. Field; A. E. Burnside; Romeyn B. Ayres; Beekman DuBarry, subsequently commissary general; Henry J. Hunt, the distinguished artilleryman of the Army of the Potomac during the Civil War; Horatio G. Gibson, until lately the oldest living graduate of the West Point Military Academy; E. B. Williston; Ramsay D. Potts; Sedgwick Pratt; Walter A. Bethel, recently Judge Advocate General of the Army; Peyton C. March, Chief of Staff during the World War; Wm. A. Kobbe; George P. Scriven and George O. Squier, both Chief Signal Officers of the Army; Jas. M. Ingalls, the ballistician of international reputation; Wallace F. Randolph, the

first Chief of Artillery; Charles T. Menoher, commander of the Famous Rainbow Division during the World War and now commanding the Ninth Corps Area; William G. Haan; John D. Barrette; Henry D. Todd, Jr., commanding Ninth Coast Artillery District under whose command the regiment is now serving. Besides those named there are many who rendered conspicuous and distinguished service.

In 1821 the Third was stationed along the Atlantic seaboard from Annapolis, Maryland, to Charleston, South Carolina. One company of the regiment, G, now Battery C, 62d Coast Artillery (AA), furnished the first garrison of Fort Monroe in 1824, when that fort was established. In 1827 the station of the Third was changed to the New England Coast with headquarters at Fort Independence, Massachusetts. In 1831 B and E took station at Fort Monroe, whence next year B was sent to Charleston, South Carolina, to assist in putting down the nullificationists; proceeding thence to the disturbed Seminole and Creek Indian districts of Florida and Alabama and was present when the Florida War broke out, precipitated by a tragic event familiarly known as Dade's massacre. On December 28, 1835, Brevet Major Francis L. Dade, 4th Infantry, with C of the Second Artillery, and B of the Third while marching from Fort Brooke, Tampa Bay, to Fort King, Florida, was ambushed by Seminole Indians near the crossing of the Withlacoochee River, Florida, three privates only escaped, one of whom belonged to B Company and although badly wounded made their way back to Fort Brooke with news of the massacre. Upon receipt of this intelligence, the steps of the whole regiment were at once directed toward the scene of hostilities where A, D, and E arrived in June, 1836; I already was in the theatre of operations. B, after its annihilation, was reorganized in Massachusetts, and joined the regiment in the field in January, 1837, being engaged with the enemy at Camp Monroe, Florida, February 8, 1837. Numerous engagements with hostiles took place during the year.

The regiment fought back and forth across the Florida Peninsula during the seven long years the war lasted and until nearly all the Indians had been killed or expelled. Forty-seven thousand square miles of Florida territory was occupied by an enemy by nature vindictive and revengeful, treacherous and subtle, striving for their rights and lands. The theatre of operations was a wilderness and every hummock and swamp a citadel. Driven from one fastness to another the enemy were rarely seen, and it was impossible to bring them to bay except they wished it. The service was distressing beyond description. The heat the greater part of the year was in-

tense; the water bad; the food poor. The innumerable annoying and venomous insects of the swamps rendered existence intolorable. Malaria and yellow fever were prevalent. The climate was an enemy more successful than the Seminoles and "its victims counted not by single files but by platoons if not battalions." The service of the regiment, the patient endurance and fidelity of the soldiers, the intelligence, zeal and activities of its officers, and the successes which crowned its efforts, well entitled them to the trite but hard-earned encomium, that they had done their duty. Eleven officers and 158 enlisted men fell victims to the climate or were struck down by hostile bullets and tomahawks. The casualities of the Third, whose services in the war were longer than that of any other regiment, were greater than those of any other organization, excepting only the 2d Dragoons.

The war being over, the Third, in 1842, occupied the stations from Smithville, South Carolina, to St. Augustine, Florida, where it remained until the Mexican War.

The Mexican War again brought the Third into the field. A, E and I, with other troops were sent in 1845 to Corpus Christi, Texas, forming General Zachary Taylor's army of occupation. A and I as part of the Artillery Foot Battalion were present when the opening gun of the war was fired at Palo Alto, May 8, 1846, and on the following day again were engaged at Resaca de la Palma. The Artillery Foot Battalion, serving as infantry, under command of Brevet Lieut-Colonel Thomas Childs, Captain 3d Artillery, formed the right of the American left wing; near the center of the line. During the height of the battle this battalion was advanced to support the 18-pounder battery on its right. This battery consisted of two 18-pounder guns mounted on siege carriages drawn by ten yoke of oxen and was commanded by Lt. Churchhill, 3d Artillery. A strong demonstration of cavalry was made against this part of the line and the enemy column continued to advance against a severe fire from our artillery. The battalion was instantly formed into a square and held ready to receive the cavalry charge; but when the advancing squadrons were within close range a withering fire of canister from the 18-pounders and the fire from the square dispersed them. A brisk small arms fire was then opened on the square, but a well directed volley from the front face of the square silenced all further firing from the enemy in that quarter. This was the first case in which American infantry resorted to the square for motion and protection against cavalry. Darkness settling down closed the action on the right of the line, the enemy having been driven back from his position and failed in every attempt against our line. At

Resaca de la Palma the artillery battalion formed the reserve and wagon train guard and as the enemy was driven from his position was ordered to pursue. The retreating Mexicans were rapidly followed to the Rio Grande River, few prisoners were taken but a number of the enemy were supposed to have been drowned in attempting to swim the river. E, during this time, equipped with four 6-pounder guns, was at Fort Brown, now Brownsville, Texas, forming part of the garrison which for 160 hours stood off and finally repulsed an overwhelming besieging force. Shortly afterwards it was mounted as light artillery. Braxton Bragg, commanding, with George H. Thomas and John F. Reynolds as assistants. A wonderful trio! The first the victor of Chickamauga; the second at Nashville; and the third the incomparable commander of the First Army Corps who fell in the forefront at Gettysburg.

Under the Act of May 13, 1846, authorizing 100 privates per company, many companies in the field were broken up, the men transferred and the officers sent home to recruit. This happened to I, July 7, 1846. Its place was filled by B which arrived at Mier, Mexico, July 31, 1846, under command of Captain Vinton.

In the movement against Monterey A and B were part of the artillery battalion, armed as infantry, which together with the 8th Infantry and Light Battery A, 2d Artillery formed the 1st Brigade, 2d Division (General Worth). This division led the advance, leaving Camargo on the Rio Grande the last of August, 1846. E, mounted as light artillery marched with the 1st Brigade, 1st Division (General Twiggs). The distance to Monterey is 180 miles and that region for the most part was described as rough, dry, desolate and dreary. In the attack of September 21st on Monterey Worth's division was charged with the duty of the turning movement and main attack. A and B formed part of the storming column sent against Loma de Federacion, which gallantly carried the position and promptly turned the captured guns on the adjoining Mexican fortifications. Throughout the day they toiled up the steep slopes, through the cold rain exposed to the violent storm of the elements and the fire of the enemy on the heights. As the sun went down the joy of victory was so great that it made the hardships seem a pleasure, and even the wild storm did not abate the expressions of their triumph. The American losses were slight. Experience has shown that heights are generally carried without entailing heavy losses. On the following day at 3:00 a. m., A, under Captain Vinton, headed the advance up the heights of the hill Independencia and at daybreak arrived within 100 yards of the crest before being discovered by the enemy. A well delivered fire followed by the bayonet gave the works

to the Americans. The enemy fled in confusion closely pursued by A Company. The Bishop's Palace, a dominating strong, point was taken and thence from house to house into the center of the city which then capitulated on the twenty-third.

While Worth's division was attacking the left of the Mexican line, E under Bragg, with the 1st Brigade, 1st Division advanced against the Mexican right. The gallantry of this light battery was never surpassed. Its fire could make but little impression upon the substantial earthworks and heavily built houses of the city, but whenever the enemy showed themselves in the open they were at once assailed by a rapid and accurate artillery fire which quickly caused them to seek shelter.

Soon after this event nearly all the regular troops, including A and B, and many of the volunteer commands were transferred to General Scott's Army destined to the attack on Vera Cruz, and the City of Mexico. Worth's division left Saltillo for the Rio Grande January 9, 1847. Light batteries C and E alone of the Third were left to General Taylor. The former under the command of Captain Braxton Bragg, who was transferred November 7th, and the latter under Captain Thomas W. Sherman, who had been arbitrarily kept out of its command by General Taylor, but who was now assigned to his proper station, joining February 14, 1847, just in time to take part in the battle of Buena Vista.

The American forces being divided and Taylor left with only 4600 men, of whom only 476 were regulars, General Santa Anna determined to act and attacked with the Mexican Army. The result was the Battle of Buena Vista, fought February 22-23, 1847, which shed unfading luster on the American arms and particularily upon the artillery.

The pass of Buena Vista, called by the Mexicans La Angostura, breaks through a lofty mountain chain running from east to west six miles south of the city of Saltillo. It varies in width from one and one-half to four miles and is about eight miles long. The western side of the pass was so cut up by deep gulches as to be impassable for any troops. On the eastern side were several plateaus, separated by ravines running from the mountain slopes to the middle of the pass. Most of these ravines could be crossed by infantry but with difficulty. It was upon these plateaus and around the heads of the ravines that the main part of the fighting of Buena Vista was done. The line of battle extended eastward along the middle of the larger of these plateaus for about 3000 yards at the beginning of the battle but shifted considerably throughout the engagement. It was along this extended front that General Taylor placed his small

army, and against them marched Santa Anna's Mexican forces of over 14,000 especially formidable in artillery and cavalry, which were the favorite arms of the Mexican General.

The battle opened on the afternoon of the 22d of February, 1847, and continued throughout the 23d. The volunteers on our left gave way and fled, but the center and right held. The American artillery was everywhere upon the field; galloping from place to place, into action for a few moments directing a destructive fire against overwhelming numbers of the enemy and then rushing to another position. It was late in the afternoon of the 23d when the critical and deciding moment came. The powerful Mexican reserve, several thousands strong, advanced on our right and center in a perfect blaze of fire driving our troops before them. It was a single column composed of the best soldiers of the Mexican Republic and having for its advanced battalions the veteran regiments. There was nothing impeding the progress of the enemy but the pieces of Lieutenants Thomas of E Battery and O'Brien, B, 4th Artillery; and though their infantry supports were gone, they fell back no faster than the recoil of their guns would take them. The advance of the enemy column, however, was not retarded for they were troops of the old line. It was a critical moment and a most perilous situation. Still onward came the Mexicans; no troops could have behaved better than they did. Canister tore through them, but there was no faltering; the wide gaps opened in their ranks were immediately closed up, and the men still pressed on. Just as the Mexicans reached the muzzles of O'Brien's guns and closed about them Captain Bragg with C Battery, closely followed by Captain Sherman with the rest of E, their horses jaded, came onto the plateau through the retreating infantry under whip and spur and wheeled into battery. Captain Bragg, with a rueful look at the retiring infantry, remarked to General Taylor, as he was doing this, "I will lose my guns, for I have no supports." "Oh," replied Taylor, "Major Bliss and I will support you." It was on this occasion that the famous remark, "A little more grape, Captain Bragg," is purported to have been passed, but far from wasting time on imaginary grape, General Taylor called out in clarion voice, "Give them hell, Captain," and hell broke loose. The guns belched forth a storm of iron and lead which prostrated everything in their front. In the words of a participant on that day, "Nothing could withstand the terrible fury. The struggle was most desperate. The whole air vibrated with the rushing current of balls. The Mexicans fought as they never fought before, and with utter disregard for life. Each moment the artillery fire seemed to grow more destructive. At

length the head of the Mexican column began to fall back; not by retreating, but by being shot away. Others pressed on to fill the places of the fallen; but they too went down." Finding it utterly impossible, notwithstanding all were advancing to gain ground against such a tempest, the whole column faltered a moment, then gave way, and in confusion retreated to cover of the deep ravine in front. But even there the hail of cannister and shell found them, and drove them out in headlong flight.

General Taylor in his official report stated that Captain Bragg with his artillery had "saved the day," and General Wool's report stated that "without our artillery we could not have maintained our positions a single hour."

A and B after leaving Taylor's army at Monterey proceeded to Tampico, an important point of entry and the capital of a district held under military government with Colonel Gates of the Third as governor. Here regimental headquarters and D remained during the whole war, D being equipped part of the time as a 6-pounder horse-battery and particularly distinguished itself in action on the Calabosa River July 12, 1847, and proved the salvation of the Louisiana volunteers who were attacked while crossing the stream. I was being recruited and M was not yet organized.

A and B landed at Vera Cruz with General Scott's army and took part in the siege March 9-28, 1847. At General Scott's request Commodore Conner of the Navy permitted the marines of the squadron, under Captain Edson, to join the Army; they were attached to serve with the Third Artillery. During this siege, Captain Vinton of B Company was killed in the trenches by an 8-inch shell. It was one of those singular cases in which death resulted from the close proximity of a projectile in flight. His clothes were not even disarranged. The projectile afterwards recovered unexploded, now rests on his grave at Providence, R. I. The capture of Vera Cruz was an affair wholly of engineering and artillery in which the companies of the Third alternated in daily service at one or more of the 10-inch siege mortar batteries.

In organizing the army for the advance upon the City of Mexico, A, B, G, and K serving as infantry were in the Third Artillery battalion under command of Lt. Colonel Belton, 3d Artillery, in the 1st Brigade (Colonel Garland); 1st Division (General Worth) and here the battalion remained during the war. The battle of Cerro Gordo was fought April 17-18, 1847. The city of Puebla was entered without resistence May 15, 1847. A was stopped at Perote and I took its place in the battalion, it having participated in the battle at National Bridge, June 11-12, 1847. B, G, I and K formed

the foot battalion of the Third and advanced with the army from Puebla, August 7, 1847.

The battle of Contreras was fought and won by Twiggs division a little after sunrise, August 20, 1847. The reinforcements from Worth's division—Garland's brigade—ordered during the night, barely reached the field when ordered to return to their former position. Worth's division on the right then moved against the fortified village of San Antonio and Churubusco. The Third advanced on the extreme right and men from this regiment were among the first to enter the bridge head redoubt, having climbed over the parapets on the left face under heavy fire. Using one of the captured guns they pursued the retreating enemy along the highway towards the City of Mexico.

The fruitless armistice which followed this event having been terminated, the battle of Molino-del-Rey was fought September 8, 1847. Molinos-del-Rey (The King's Mills) were a hugh mass of red sandstone buildings used as a cannon foundry and powder factory. Heavy thick walls extended three or four feet above the roofs, and the yards and courts between the detached buildings were closed by thick, strong doors barred by heavy wooden beams and guarded by stone or earth barricades, all was commanded by the castle of Chapultepec on a height in rear.

Garland's brigade was placed on the right of the American line opposite the Molino. A selected storming party of 500 including 50 men of the Third formed next on the left. Advancing at 3:00 a. m., this column when close to the front of the mills came under a heavy cross fire of musketry at close range and suffered many casualities, 12 of the 14 officers of the command fell during the first five minutes. Quickly reinforced by Garland's brigade they fought their way into the buildings breaking through barricaded gates and doorways while exposed to a close fire from enemy on the roofs and behind barred windows. The enemy when driven from one position would retire to another, contesting every inch of ground, roof, floor and walls. After two hours of stubborn fighting the main buildings were taken and the Mexicans captured or driven out. It was a brilliant but costly victory, one quarter of the American command were casualities.

Chapultepec alone remained to be fought—September 12-14, 1847—and all the Third with the army was engaged. The Second and Third Artillery having suffered such heavy losses at Molino del Rey, were temporarily formed into four companies. They moved with Worth's division along the causeway driving back the enemy until at San Cosme garita night put an end to the battle. The next day the Capital City was entered.

The war was practically ended when the City of Mexico was captured, September 14, 1847. There were a few brushes with the enemy besides the heavy fighting already mentioned. A equipped as field artillery was present at Huamantla, October 9, 1847, at Atlixco, October 19, 1847, and at Matamoras, near Puebla, November 23, 1847. These were the last among Santa Anna's guerilla warfare and A won high encomiums for its conduct.

The army evacuated the City of Mexico June 12, 1848, and Vera Cruz July 16, 1848. Worth's division, the last to leave the Mexican capital assembled in the Grand Plaza at 6:00 a. m., the American flag was hauled down and saluted by B Battery, then by a Mexican battery, after which the Mexican flag was hoisted. M saw no fighting in the war. Leaving New York for the scene of hostilities October 12, 1847, it was wrecked and put into Charleston, S. C., November 5. Left Fort Moultrie December 17, and arrived at the City of Mexico early in 1848, where also was established regimental headquarters. Colonel Gates remained as governor of Tampico and Captain Martin Burke temporarily commanded the regiment. At this time the companies of the regiment were distributed as follows: A, Perote; B, G, H, I, K, L, M, City of Mexico; C, E, Walnut Springs near Monterey, Mexico; F, Monterey, California, where it arrived early in 1847; D, Tampico. C and D were equipped as horse artillery; A, E, and H as field artillery; the rest were armed as infantry. The regiment except C, E, and F was concentrated at Fort Monroe and thence distributed to the New England stations which they had left thirteen years before the Florida War. E left Fort Brown, Texas, October 26, 1848, for Fort Trumbull, Connecticut.

Soon afterwards the Seminoles who had been left in Florida became restive. Accordingly, in September, 1849, B and D embarked for Palatka, Florida, near the scene of disturbance. Here they remained marching through the swamps until order was restored, when they returned to their stations in 1850. The regiment now looked forward to the enjoyment for a while at least of a quiet life. But this hope was short lived. In the nature of things it could not long be indulged in. We had acquired on the Pacific Coast a vast and unsettled territory by conquest; it was inhabited by savages or semi-savages. The army was needed to keep them in subjection.

In October, 1848, M sailed for California around Cape Horn to join F. The movement of the regiment, though contemplated was deferred. But our recently conquered subjects were restless and had to be kept in order. With this object in view B was sent early

in April, 1853, to Texas, where it remained until early in 1854. This was a fortunate circumstance as it missed one of the direst calamities that has ever befallen our army on the seas.

The deferred movement of the regiment to California was ordered in 1853. On December 21st, Headquarters, the band, A, D, G, H, I, K and a large detachment of recruits embarked for California, via Cape Horn on the steamer *San Francisco.* The vessel was new, its machinery excellent and it was believed to be seaworthy. Of the 600 aboard, 500 belonged to the regiment. On the 22d the vessel was at sea. The 23d ended with a fresh breeze, cloudy and threatening weather. Out of the ominous calm that night a wind came up with terrific force from the northwest. Mountainous waves swept over the ship, disabled the machinery and soon rendered the vessel unmanageable. At 9:00 a. m., 24th, a hugh wave struck, stripping everything from the upper deck including the saloon, in which a large number of soldiers and other passengers had taken refuge. It is estimated that 175 souls perished at this time. Nothing could exceed the terror of the situation. To add to the horror of the storm the vessel sprung a leak and was kept afloat with difficulty. On the 25th the brig *Napoleon* was spoken but sailed away to Boston. On the 26th another vessel was sighted but lost in the night. The men now began to die from exposure and exhaustion. On the 28th the bark *Kilby* of Boston stood by the wreck and on the following day ran a hawser and took off 108 passengers. That night the storm freshened, the hawser parted and the *San Francisco* drifted out of sight. After vainly searching two and a half days the *Kilby* sailed for New York. At 9:30 a. m., 31st, the British ship, *Three Bells,* of Glasgow, was spoken and lay to. The storm raged unabated. On January 3, 1854, the *Three Bells* was joined by the *Antartic* of Liverpool. On the 4th and 5th all survivors were transferred to these two vessels. The *Three Bells* sailed for New York. The *Antartic* carried her 142 survivors to Liverpool, England, which port was reached January 23; the first American troops to land in England. On February 1st they embarked on the steamship *America* and arrived at Boston, February 16th.

Nothing daunted, the Third was soon again enroute, this time by the Isthmus of Panama. Headquarters, B and L, embarked at New York, April 5, 1854, on the steamer *Illinois* and arrived at Benicia, California, May 5, following. The band with D, G, I and K were not so fortunate. Embarking on the steamer *Falcon* they nearly repeated the experience of the *San Francisco,* but though disabled the vessel managed to make Hampton Roads where the troops were landed at Fort Monroe. In May, 1854, they were

picked up by the steamer *Illinois* and finally, after many tribulations reached the California shore.

A and H marched overland from Fort Leavenworth, May 29, 1854; wintered at Salt Lake City, resumed the march to California April 4, 1855. The summit of the Sierra Nevada mountains was crossed July 1st; Benicia was reached July 12th. Almost immediately afterwards A was sent to Fort Yuma, California, where it remained for three years.

From 1854 to 1861 the Third was actively employed in marching and scouting over the Pacific Coast through its length and breadth. There was not an Indian tribe from the Rockies to the Pacific whom they did not visit. Scarcely had D landed at Benicia when it was sent on an expedition against the Indians of the Pitt and McCloud rivers. B marched against the Yakimas in October and November, 1855. During the same year D was engaged against the Klamath and M against the Puget Sound Indians. In the action at Hungry Hill, October 31-November 1, 1855, Lieutenant Horatio G. Gibson, commanding D was wounded. It was only recently that General Gibson, for many years colonel of the regiment and the oldest living graduate of West Point, answered the call of the Great Beyond. In the winter of 1855-56, B was sent against the Rouge River Indians, then on the war path. They were attacked at their village, Mackanootney, Oregon, March 28, 1855, routed and their village burned. On April 28th, following they were met and defeated again. In June, 1856, they sued for peace. General Scott in orders from Army Headquarters complimented the troops for their gallant conduct in the war. In the same order the services of M on Puget Sound were mentioned with commendation. E also was doing good work in Minnesota under its indefatigable Captain T. W. Sherman. The Indians at Yellow Medicine Agency began to manifest an ugly disposition. Sherman took their breath away by appearing among them with his battery, thus, in the language of General Order 14, Hdqrs. of the Army, 1857, "by his promptness, judgment and firmness preserving the country from a war with the tribes of the Sioux Nation."

In May, 1858, after two years of quiet the Indians in Washington Territory suddenly went on the war path. The uprising was entirely unexpected, but the news spread and the neighboring tribes flew to arms. Safety to the frontier settlements required the chastisement of the Indians. Accordingly an expedition was fitted out for this purpose under Colonel Wright, 9th Infantry. The Third composed the major part of the troops and they were rapidly concentrated. A from Yuma; B, Rouge River; D, San Diego, where

it had taken station February 1, 1858, and M the Presidio of San Francisco with other troops were united at Walla Walla, Washington. The Indians were vastly more numerous than the troops but the latter were armed with rifle-muskets, just then issued to the army, the former with smooth-bores which were ineffective within range of the rifle-muskets. The Indians were signally defeated at Four Lakes, September 1, Spokane Plains, September 5, Spokane River, September 8, 1858. The principal chiefs were captured and hanged and the tribes so humbled that they have never gone on the war path since. In general orders from Headquarters of the Army, General Scott testified his appreciation of the regiment in this campaign in most eulogistic terms.

In 1859 the dispute over the British Columbia-Washington Boundary line and who should own San Jaun Island, seemed likely to precipitate war with Great Britian. Accordingly August 8, 1859, A, B and D left Fort Vancouver, Washington and joined other troops at Camp Pickett on the southern, while British troops occupied the northern end of the island. In this position the forces of the countries glared at each other; but as there was no fear of immediate hostilities after General Scott arranged for joint occupation, the companies mentioned returned to Fort Vancouver in December, 1859.

Early in 1860 D and I were sent on an expedition into Nevada, where they attacked and defeated the Indians, under Young Winnamucca, near Truckee River, June 2, 1860. In July of the same year A, B and M left Fort Vancouver, Washington, scouted through the Snake River Country, met and routed the Indians at Harney Lake, Oregon, and returned to Fort Vancouver in September.

When the Civil War was precipitated the Government was extremely anxious about the temper of the states on the Pacific Slope, particularly California. This led to energetic measures to secure the safety of San Francisco. All of the companies of the Third on the Coast, except D were at once concentrated in that harbor. In October, 1861, regimental headquarters and five companies including M were embarked for New York via Isthmus of Panama. This left A, B, and I at San Francisco, and D at Vancouver, the latter proceeding in February, 1862 from Camp Pickett, San Juan Island, to Alcatraz, San Francisco. Here B and D remained during the whole war. I was sent east in 1864, and equipped as a light battery. A, in February, 1862, equipped as light artillery, proceeded to Camp Drum, Wilmington, California, and there joined General Carleton's column which marched in 1862, from California, across the deserts to Tuscon, Arizona, and then into New Mexico, where it served as

a light battery until 1865 when it was transferred to Boston Harbor. While in New Mexico the light battery saw exceedingly hard service. It marched much of the time, when not as artillery against the Indians as cavalry. No company of the regiment saw harder service during the war than A.

We now turn to the companies in the great theatre of the Civil War. E came from Fort Ridgely, Minnesota, in May, 1861, and was present at Blackburn's Ford July 18, and again at Bull Run July 21, 1861. At Bull Run it had to content itself with engaging the enemy at long range. It assisted with other batteries to cover the retreat of the army. In these engagements it lost three men killed and two wounded. Soon afterward E started on an expedition to the South along the coast of South Carolina and Florida, where it kept active until February, 1864. It was engaged June 10, 1862, at Secessionville, South Carolina, at Pocataligo, October 22, where hard fighting was done. It joined in the assault and repulse at Fort Wagner, South Carolina, July 18, 1863, and was engaged in the siege of that place July 18 to September 7, 1863. On the evening of July 12, 1863, from a position on an advanced point on Morris Island the battery opened fire on an enemy steamer lying in Charleston Harbor and succeeded in completely disabling it. On February 20, 1864, it was present at the sanguinary battle at Olustee, Florida, and suffered great loss. All the officers were wounded; 12 men were killed, 21 wounded and 6 missing. This terminated the service of E in the South. In April, 1864, it was assigned to duty with the Army of the James, being part of the artillery brigade of the 3d Division. It was present at Port Walthall Junction May 19-20, 1864, and all the battles in which that army was engaged, afterwards in the entrenched lines at Bermuda Hundred and on both sides of the James River, and in the works before Petersburg from August to September. It was present at Laurel Hill, October 7, 1864, when the 10th Corps repelled Longstreet. It was present at both attacks on Fort Fisher, North Carolina, having several skirmishes with the enemy. In March, 1865, E with the 10th Corps joined General Sherman's Army engaging in the pursuit of General J. E. Johnston, until the final surrender of the Confederate forces. E remained in South Carolina until August, 1868, when it marched to Atlanta, Ga., where the battery was dismounted March 2, 1869. The troops were sent to St. Augustine, Florida, for station from which place it moved to Fort Pulaski, Georgia, August 6, 1869.

When McClellan's army moved to the Peninsula in 1862, the batteries of the Third including M were attached to the Army artillery. M was engaged at Newbridge, Virginia, June 19; Mechanics-

ville, June 26, and Gains' Mill, June 27, 1862. At the latter place it was on the right, about 500 yards in front of the line where it fought with great gallantry and under great disadvantage, the battery commander being wounded, and all the horses killed. During the change of base to the James River, it fought at Turkey Bend, June 28-29; at Turkey Bridge, June 30; at Malvern Hill, June 30-July 1, 1862, during which all its lieutenants were wounded. It was present at Fredericksburg, Va., December 11-15, 1862, but the jammed condition of the street prevented its going into action. In March, 1863, when the 9th Corps was sent West, M accompanied it. The corps arrived at Vicksburg in season to take part in the siege of that place and afterwards, July 10-16, in the siege of Jackson, Mississippi. From this time until March 16, 1864, M operated in the West. On May 24, that year it again rejoined the Army of the Potomac. All this time it formed part of the artillery of the 9th Corps. It took part meanwhile in Burnside's campaign in East Tennessee in 1863, was engaged at Philadelphia, Tennessee, October 16th, Campbell Station, Tennessee, November 16th, was in position in the trenches during the siege of Knoxville, Tennessee, November 17th-December 5th; in pursuit of Longstreet's Army at Blain's cross-roads, Tennessee, December 17, 1863; and again at Strawberry Plains, Tennessee, January 2, 1864. Its next fighting was in the Wilderness, under General Grant, from May 5 to 14, 1864, whence it was sent back to the defenses of Washington where it was joined by I. They remained in a condition of preparedness for active service; but from this time on, except when Early made his attempt on Washington in July, 1864, nothing seriously demanding their attention occurred.

Following the Civil War the batteries and companies of the regiment were moved from station to station throughout the United States. The stations of the regiment alternated between the North Atlantic, and South Atlantic and Gulf Stations. By the Act of Congress, July 28, 1866, the term battery was applied to all artillery companies. Prior to that time the designation battery was used only for the companies equipped as field artillery.

In 1876, the year of the Custer Massacre, several batteries were ordered to the Department of the Platte, which embraced the Middle Western States. They were returned to their seacoast stations after quiet had been restored.

The most desperate and extensive strike that has yet occurred in the country was that of 1877, by the employees of the principal railroad trunk lines, the Baltimore and Ohio, the Pennsylvania, the Erie, the New York Central, and their western prolongations.

Freight traffic was entirely suspended and passenger and mail service was greatly impeded. When new employees sought to work militia had to be called out to preserve order. Bloody riots were common occurances. In July, at the requests of the governors of the states involved, President Hayes dispatched regular troops including the Third, to Pennsylvania, Maryland and West Virginia. Faced by these forces the rioters in every instance gave way without bloodshed and normalcy was restored.

In 1896 the regiment was transferred from the Gulf Stations to San Francisco, where it was stationed at the outbreak of the Spanish War.

In June, 1898, a battalion of four batteries—G, H, K and L—under command of Major (now Major General, retired) William A. Kobbe, Third Artillery, sailed for the Philippines as part of the Third Manila Expedition. The battalion participated in the attack and capture of Manila and later served creditably during the Phillipine Insurrection.

A, consisting of four officers and 191 enlisted men embarked at San Francisco, California, August 20, 1898, on the steamer *Humbolt* for service in Alaska. One officer and 72 enlisted men were debarked September 3, at St. Michaels, while the remainder of the battery proceeded to Ciocle City, arriving September 29th. The following August, A returned to San Francisco.

The Act of March 2, 1899, added two batteries to each artillery regiment. N and O were organized at Presidio of San Francisco.

The Boxer uprising in China called for the presence of all available troops. A, D, I and O embarked at San Francisco, July 28, 1900, on the transport Hancock and arrived at Taku, China, August 20th; then moved by rail the following day to Teinsin where camp was established in the compound of the German concession. September 7th the battalion moved to the Chinese Government inclosure designated Liscum Barracks, named in honor of General E. H. Liscum who was killed at the battle of Teinsin July 13th. Here the battalion was assigned to the 2d Brigade, China Relief Expedition. The batteries of the Third were the only Coast Artillery organizations which participated in this expedition. The brigade being discontinued October 21st, the batteries were transferred to Manila, which port was reached November 20. Therefrom they were immediately sent into the field and actively participated in numerous engagements with the Insurrectos.

The Act of February 2, 1901, discontinued the regimental organization of the artillery arm and constituted an Artillery Corps, consisting of coast and field artillery, comprising 126 companies of

coast artillery and 30 batteries of field artillery, which were given serial numbers in their respective branches. The strength of each coast artillery company was fixed at three officers and 109 enlisted men. The serial numbers assigned to the batteries now comprising the Third Coast Artillery are given at the beginning of this sketch. They were stationed as follows: 25th, 27th, 31st, and 36th Companies, Phillipine Islands; 26th Company, Fort Flagler, Washington; 28th Company, Presidio of San Francisco; 34th Company Fort Stevens, Oregon; 35th Company Fort Moultrie, S. C.

The four companies in the Phillipines returned in April, 1903; 25th and 27th Companies took station at San Francisco; 31st, Fort Caswell; 36th, Fort Moultrie. 28th Company was stationed at Camp McKinley, Honolulu, H. I., from April 30, 1904, to July 11, 1905, whence it proceeded via San Francisco to Fort Rosecrans, San Diego, California, for station, arriving July 25, 1905. 35th Company served in the Phillipines from 1908 to 1910, returning after its tour to Fort Monroe. 36th Company was transferred in 1909 to Fort Du Pont, Delaware, from which place it was sent to the Phillipines.

All of the companies of the old Third stationed at San Francisco on the occasion of the disasterous earthquake and fire of April 16, 1906, were called out and rendered invaluable assistance in preserving order and guarding property. Their services were officially recognized by resolution of the California State Legislature.

From 1911 to the outbreak of the World War during disturbances in Mexico E saw considerable service in the field along the Mexican border of Lower California, preserving the neutrality of the United States and serving as border patrol. C was present with the First Separate Brigade at Galveston, Texas, in 1911.

In compliance with War Department instruction of June 27, 1916, and General Orders No. 31, War Department, July 24, 1916, the serial designations of coast artillery companies were changed from a single series to separate series for each fort. Subsequently in July, 1917, this arrangement was again changed and companies were designated serially for each coast defense. Under this system the identity and origin of the old organizations were lost and confusion entailed in attempts to compile historical data and chronicle of events pertinent to the World War. The Chief of Coast Artillery perceiving the chaotic condition into which records had become involved instituted an exhaustive research and study of the organization of all coast artillery units which work was performed in an excellent manner by the late Colonel R. H. C. Kelton, Coast Artillery Corps. As a result of his research the historical continuity of

the coast artillery organizations was established and General Orders No. 21, War Department, 1922, issued, which order restored to the old companies the serial numbers assigned in 1901.

The World War having demonstrated the advantage and need of regimental organization in the coast artillery, General Orders No. 8, War Department, 1924, issued, effecting the arrangement of the Coast Artillery Corps, not already so formed, into regiments. In carrying out the provisions of this order the former seven regiments discontinued in 1901 were reconstituted by placing in each regiment as many as practicable of the batteries which formerly belonged to it. Eight of its former batteries were assigned to the Third Coast Artillery.

At the outbreak of the World War the batteries of the regiment were stationed as follows: Headquarters Battery, Coast Defenses of Manila and Subic Bay; A and D, Coast Defenses of San Francisco; B, Puget Sound; E, Fort Rosecrans, San Diego; C, Fort Caswell, N. C.; F, Fort Stevens, Oregon; G, Fort Monroe, Va. A was assigned as Battery C, 18th Artillery, which regiment was disbanded in December, 1918; D was sent overseas in November, 1917, as the 4th separate antiaircraft battery and saw active service on the western front; C became Battery E, 53d Artillery, manned railway guns and participated in action in the Champaigne sector, Aisne-Marne defensive, St. Mihiel and Meuse-Argonne offensives. The remaining batteries remained at their fixed batteries and served as nuclei for regiments and other units organized for war service.

When additional companies of coast artillery were formed in 1901, the 92d, 93d and 94th, now batteries of the 14th Coast Artillery, were organized by transferring alternate men from the 28th, 34th and 36th Companies, respectively. Former batteries G, I, K and L of the Third Artillery were assigned to the 62d Coast Artillery when that organization was expanded into a regiment in 1922. The former band is the band of the 6th Coast Artillery; former batteries C and F are batteries E, 1st Field Artillery, and A, 3d Field Artillery, respectively.

The Third Coast Artillery was constituted with fitting ceremony at Fort MacArthur, California, July 1, 1924. Major General William A. Kobbe, retired, was the guest of honor, representing the old Third Artillery, in which regiment he served for over thirty years. He reviewed the organization and presented its colors. Colonel Ben H. Dorcy, retired, whose first service was as private and corporal, Battery E, represented the enlisted men of the old Third and presented the battery guidons. The reorganization was made

an occasion for local celebration in which naval, veteran and all civil organizations of the community were present and participated.

Regimental Headquarters, Headquarters Battery, 1st Battalion, including Batteries A and B, are stationed in the Coast Defenses of Los Angeles, Fort MacArthur, California; the 2d Battalion, Batteries C and D, in the Coast Defenses of San Diego, Fort Rosecrans, California; the 3d Battalion, Batteries E, F and G, in the Coast Defenses of the Columbia, Fort Stevens, Oregon.

The Third Artillery stood upon its record. It ever did its whole duty and never intrigued to impose that duty on another. The history and traditions of that organization are perpetuated in the reconstituted regiment. Our duty is to emulate the devotion to service of the rank and file who have gone before and preserve the heritage bequeathed by those artillerymen who were prepared for any service that duty might call.

In all our wars—always forced upon us—we have as a nation entered absolutely unprepared. One would think that such experiences, costly beyond estimate in money and loss of life, would prove effective warnings against a repetition, but the warnings have not been heeded nor the lesson learned. The old cry, "The war just ended will be the last one in the world," still finds ready listeners, and Government appropriations continue to be inadequate. There is much talk about the immense sums annually spent upon pensions and other public burdens which come as the aftermath of our wars. Had we long ago adopted and adhered to an efficient military policy, such as that which for the first time in our history is now furnished by this national defense act, it is probable that war might have been avoided, and it is certain that the cost in life and treasure and the burden forced on succeeding generations would have been enormously reduced. It is usual to blame politicians and the lawmakers for the lack of adequate legislation and appropriation, but they are much less to blame than the people of the country at large who through supineness and lack of vision are indifferent to the necessities of a national defense program in peace as well as in war. An active interest by the voters in the proper defense of the country would inevitably be reflected in the actions of Congress. The issue cannot be dodged without paying the penalty.—*Major General Hunter Liggett in "Commanding an American Army."*

Limitations of Aircraft in Naval Warfare

By LIEUTENANT COMMANDER SIDNEY BALLOU, U. S. N. R. F.

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WITH an adequate air service one of our greatest present day necessities, it may seem inadvisable, as well as ungracious, to emphasize the limitations of aircraft. Unfortunately, however, aircraft enthusiasts have not contented themselves with constructive argument as to the value of this new instrument of warfare, but are preaching the doctrine that old and tried instruments may be dispensed with, particularly if they are expensive, and that the national defense may largely, if not wholly, be entrusted to the new and cheaper arm. A brief catalog of some of the limitations to which aircraft are subject may therefore tend to a saner, if less sensational, view of the probability of their fulfilling all the expectations claimed by their protagonists.

In the destructive side of aircraft propaganda it is noteworthy that the Navy is signalled out for attack. An anchored battleship, with no means of defense, is sunk after a day's bombing and the word goes out at once that the battleship is obsolete. An entire brigade of infantry, represented in dummy form, could, under the same conditions, be wiped out in less time, but this experiment is never tried and no one rushes into print with the proposition that the infantryman is obsolete. There is an utter lack of contention that no more of the taxpayers' money should be spent on field guns and tanks, so easily wiped out by a single bomb from the elusive airplane.

One might think that this failure to enthuse over the destructive power of aircraft against land forces was due to the fact that there are too many men alive who have seen it tried under actual service conditions. This cannot be the explanation, however, for the achievements of airplanes on land, little as they tended to prove aircraft more than a strong auxiliary arm, were overwhelming in comparison to the infinitesimal damage done by airplanes to ships. So far from getting any comfort out of naval experience during the war the aircraft exponents are driven at the outset to throwing overboard all war history and to depending wholly on postwar developments in aviation to form the basis which war experience refuses to supply.

Whatever may be the reason, it is certain that those who conceive it their duty to exalt the air service at the expense of the other branches are busy pulling down the Navy and not the Army. It is with relation to naval warfare that they hope to convince the country that old principles are obsolete, that old arms should be scrapped and that the air service should rise triumphant above the scrap heap. It is with relation to naval warfare, therefore, that some of the limitations of aircraft will be examined.

Sea Power.—Sea power being the force to be conquered and supplanted, let us attempt to visualize sea power by a concrete example. Within a few months from the outbreak of the World War every German raider had been driven from the ocean, a period of time likely to be lessened as the use of wireless on merchantmen becomes universal. For four years the Seven Seas were highways for the Allies and the Allies alone. Ships were bringing rubber from Singapore, nitrates from Chile, wheat from the Argentine, and above all, supplies, munitions and afterwards the decisive troops from America. Germany was getting nothing except what was available by way of her land communications, one closed sea and two perilous trips of a cargo submarine. All this was possible because at Scapa Flow, 500 miles from the nearest German port, lay a fleet of battleships of such strength that the German Navy dared not force it to decisive action.

Sea power is itself but an auxiliary arm. Its own guns can range but a short distance inland. Its sole function is to assure supplies and communications over the high seas to its possessors and to deny them to the enemy. Nevertheless, so vital are supplies and communications to armies and so necessary to them are the highways of the sea that sea power is usually the decisive factor in great wars.

It will be observed that the control of seas is not in proportion to the strength of the rival navies. Because the fleets are in proportion of sixty to forty does not mean that the superior fleet commands sixty per cent of the waters of the earth and the inferior fleet forty. The portion of the superior fleet is the entire ocean, that of the inferior fleet is zero.

Radius of Action.—Against sea power, thus holding dominion over the Seven Seas, it is now proposed to launch air power. From what point? The trade routes of the earth were bearing assistance to the Allies, but not the most imaginative can envisage improved airplanes leaving Germany to seize and hold the trade routes of the earth. Even the most important route, the ocean lane from Hoboken to Brest or Bordeaux, over which troops and supplies were pouring,

is as much beyond the radius of action of any postwar plane based on Germany as it was out of reach during the war. If planes improve it is only necessary to shift terminals and make the land route a little longer. We could have landed at Marseilles if necessary.

If it is proposed to strike directly at the heart of sea power, at the battleship fleet whose existence is paralyzing surface operations, the same weakness is manifest. In holding the seas, the main fleet of heavy ships is not obliged to lie within the striking distance of airplanes based on an enemy port. Blockaders have already been driven back by the threat of torpedo craft, and may be driven back further, but wireless communication more than compensates for the distance. The blockade of the next war will be a further extension of the elastic blockade, based on light craft inshore with heavier ships within supporting distance.

Briefly, then, aircraft are too limited in radius of action to wage successful war on sea power. The theatre of operations is too large. A battle fleet radiates lines of power from its position like a queen on a chessboard. It can check from the opposite side of the board. A knight can attack and even capture a queen without danger to itself if it can get near enough and in the right position, but when a knight is proved to be stronger than a queen, then an airplane will be stronger than a battleship.

Aircraft Carriers.—It is to remedy that fatal lack of radius of action that planes are to be put aboard carriers. Now they can be brought to any vital point. The terminology of the argument shifts a little, for now the potency of sea power is admitted, but it is to be exercised by a different type of capital ship. Old principles are to remain unaltered, except for the contention that a ship armed with bombing and torpedo planes is superior to one armed with 16-inch guns. Before two such ships are placed in tactical contact, however, there are numerous complications to be discussed.

The first limitation on aircraft carriers is artificial, but it is none the less real. They are limited by the Washington Treaty. Against our ultimate 525,000 tons of battleships, supported by 135,000 tons of carrier capacity of our own, the only carriers we have to figure on are 135,000 tons of Great Britian, 81,000 tons of Japan, and 60,000 tons each of France and Italy.

Aircraft carriers are neither cheap nor can they be built overnight—two of the arguments most stressed for aircraft. Differing radically in design from other types of vessels, they cannot be readily extemporized after war is declared, assuming that war would scrap the Washington Treaty. We are therefore driven to figuring whether our fleet of eighteen battleships, with its 192 big guns, sup-

ported by our own carrier capacity of 135,000 tons, is rendered obsolete and should be allowed to deteriorate by reason of the aircraft which can be carried upon say three Japanese carriers of 27,000 tons each. Anyone supporting this thesis should do some convincing figuring for the public.

Carriers as Surface Craft.—In estimating the value of carriers as supplying the essential radius of action, we are not, however, obliged to rely wholly upon the limitations of the Washington Treaty. An aircraft carrier is a surface vessel, and when we have put our aircraft aboard we have subjected it to all the limitations of surface craft. Imagination, like the planes, must come down from the air, for now we are again on the charted seas of experience.

As a surface vessel the carrier has no more power than a cruiser, and it is against cruisers, not capital ships, that she would have to battle her way to the point where she could strike at the battle fleet. There is no more reason why she should not get there than the destroyer, the submarine or any other type of vessel that for the past thirty years has been trying to put the battleship out of business.

A variation on the idea of putting airplanes on carriers has recently appeared in the assertion that it will soon be possible to refuel airplanes from surface ships. The answer is the same. We have only to remember as far back as the World War to know that there is one sure way to keep the enemy's surface ships off the ocean and that is to have an adequate navy. If any weight is to be given to this new possibility it merely emphasizes the necessity of a sufficient number of cruisers, for against cruisers, when properly supported by heavier ships, no surface craft can operate.

It may be difficult to show the average landsman just why a fleet of heavy battleships, properly supported by cruisers and other auxiliaries, denies the seas to all lighter surface craft, but this is too familiar ground to need recapitulation here. Experience is the best guide and the experience of the war is too conclusive and too recent to require much elaboration. Once admit that aircraft must be put on carriers to bring them into action, or that they must get their fuel supply from surface ships, and they have been relegated definitely to the spasmodic raiding activities of an inferior fleet.

Limited radius of action does not prevent aircraft from being powerful defensive weapons, but defense does not win wars, nor is it a substitute for sea power. The argument on this whole point may be tersely summarized in the proposition that an airplane cannot sink a battleship because it cannot carry enough fuel. Thus put it will be found to carry a new idea to the average aircraft advocate.

Two questions will immediately arise; first, from what point the airplane start, and second, how did it get to that starting point unmolested. By the time these are given some consideration it will be found that the average amateur has been thinking solely in terms of tactics, with the two opponents already in actual contact, and that the most elementary considerations of strategy and logistics have been wholly ignored.

Tactical Weakness.—Supplementing this important strategic limitation there is an almost equally important tactical weakness. The best defense against aircraft is aircraft. The defense against air attack will undoubtedly develop along the same lines as the defense against torpedo boat attack—that is, meeting kind with kind.

Battleships have antiaircraft guns as they have antitorpedo guns, but their first and most important line of defense will be their own aircraft, just as it is now their own torpedo craft.

Here, however, there is a line of divergence. When the torpedo boat was answered by the destroyer, it, in turn, became a destroyer, and attack and defense developed along parallel lines. There is no inherent reason why a destroyer attacking a battleship should be inferior to one designed for its defense.

With aircraft it is different. The attacking ship is a bombing or torpedo plane. Its enemy is the combat plane, particularly the single-seated pursuit plane. No development in aviation, past or future, can change the fundamental relation between these two types. The pursuit planes carried by a fleet for its protection will always be faster than the bombing and torpedo planes seeking its destruction.

Speed is not everything, but in every other military weapon lack of speed is made up by some compensating advantage. The submarine is slower than the destroyer it must evade, but it has invisibility. The battleship is slower than a cruiser, but besides its enormous destructive power, it is practically invulnerable to cruiser attack. The bombing plane alone is asked to take the air against an enemy which, so far as inherent quality goes, it is not strong enough to fight nor fast enough to evade.

So far as sea-going aircraft are concerned, that is aircraft which accompany the fleet, the bomber may reasonably count on being outnumbered as well as out-maneuvered. On a given carrier displacement it will usually be possible to put at least two pursuit planes as against one bomber. A fleet which elects to defend itself in the air instead of using its air force for attack can therefore count on a substantial numerical superiority of defensive planes. In addition to those carried on the regular carriers, battleships and

cruisers, while not adapted for carrying bombers, may add their quota of combat planes.

Under these circumstances, whatever may be the future developments of aviation, there is no reason to doubt that the defense will have no difficulty in keeping pace with any new form of attack from the air.

Weather.—Next to limited radius of action and inherent weakness of attack against defense, probably the most serious limitation of aircraft is the weather.

It would seem axiomatic that in sustained operations of war no commander can afford to place his main reliance upon any force which is not available at any time and under all circumstances. He may employ auxiliary forces of a special kind, subject to special limitations, such as gas or smoke dependent on the direction and velocity of the wind. To adopt a major force of any such kind for attack is to limit attacking periods to an extent which necessity may not permit. To adopt it for defense is merely to invite the enemy to make his attack when such force is unavailable. Dependability is one of the most fundamental requisites of any military force.

The airplane is not a dependable weapon. Making every allowance for improvements in the past and in the future there remains a considerable percentage of weather during which it cannot fight. Not only severe storms but even ordinary cloud conditions frequently put it out of action.

We are all familiar with frequent postponements of flights and flying maneuvers in times of peace, when no unnecessary risks need be run, but few realize how materially air fighting is slowed up by weather in time of war. Most war narratives are diaries of achievement, with no mention of periods of inactivity, but any serious study of sustained operations shows up this defect in a striking manner. Take these extracts from the work of Admiral Sir Reginald Bacon on the Dover Patrol:

> Heavy gales and great quantities of rain were experienced during fourteen of the thirty-one days in December, 1915, and no flying was possible, while on others the conditions were such that while protective patrols were carried out over the warships off La Panne, it was not considered feasible to undertake offensive work.*
>
> A break in the weather called a halt in the continuous bombing attacks on both sides during the first two weeks of February, 1917, and, except for an occasional odd day, no flying operations were possible.†

So much for sustained operations. How easily ordinary weather on a summer day can put aircraft out of action may be judged from this random letter from the book of a British aviator:

* Bacon, *The Dover Patrol*, Vol. 2, p. 230.
† *Ibid*, p. 255.

August 26, 1915.

Dear Dad:

What do you think of forty warships bombarding Zeebrugge? We were all due out there, of course, some spotting and fighters to protect the spotters. As luck would have it the weather was dud—clouds at 1500 feet—with the result that no one got there, except a solitary fighter, and he was rewarded by a scrap with a German seaplane

HAROLD ROSHER.*

As a prelude to the greatest of sea fights it is now well known that Admiral Scheer made elaborate plans, depending on preliminary observations by Zeppelins, that he was repeatedly disappointed by weather conditions and that the High Seas fleet finally went out without the necessary information at a time when the British fleet was actually at sea.†

If we have worked ourselves into the frame of mind where we believe that air control will decide the next war within forty-eight hours we may dismiss these considerations from discussion, but if we anticipate any continuous effort we must realize that any nation depending on aircraft for its primary weapon is under a severe handicap as compared with one which can do its fighting in all weathers.

One Point in Space.—Unlike any other military weapon the bombing airplane depends wholly on the force of gravity for the delivery of its projectile. It follows that, if its target is a single object and not an area, its attack must be made from what, without mathematical exactness, may fairly be described as one point in space. A torpedo plane, considering that it is not practicable to drop a torpedo more than fifteen feet without injury to its delicate mechanism, has not much more latitude.

During the entire time that an attacking plane of either type is within range of antiaircraft guns, it is in itself an impotent target, except for one brief moment at one definite and predictable point. From the moment it is sighted the path that it must traverse to reach its striking point is known. It is only necessary to put in that path a creeping or "ladder" barrage of bursting shells to make the odds against arriving rather heavy.

We hear considerable about the development of aircraft since the War, but not so much about the development of antiaircraft weapons. As a matter of fact, some very efficient guns have been developed. We have machine guns with tracer ammunition visible up to 10,000 feet. We have a 3-inch semi-automatic, throwing shrapnel to an effective height of 21,000 feet and a 4.7-inch gun which can throw a 45-pound bursting shell higher than any bomber can

* Rosher. *With the Flying Squadron*, p. 130.
† Scheer. *Germany's High Sea Fleet*, p. 135.

climb. As we are now considering the limitations of aircraft rather than the strength of defensive measures, it is unnecessary to elaborate on the performance of these guns. The immediate point is that modern practice is not to aim at the airplane, which would be an elusive target, but to fill its predetermined path with bursting shells, which is taking advantage of a very definite weakness.

One Shot in the Locker.—When a bombing plane has battled its way against distance, against the weather, against faster pursuit planes and against antiaircraft guns to the one point at the one moment at which it can deliver its blow, what has it to deliver? Without much exaggeration it can be said: one shot.

It is true that bombers can carry a number of small bombs, but these are not calculated to sink battleships nor even to penetrate armoured decks. Airplanes that are risking their existence to mess up the upper works of a battleship are playing a game not worth the candle. It is likewise true that the heavier types of land bombers can carry several bombs of considerable size. As to these it is doubtful, as already stated, if battleships will be found within their range of flight, or whether a multiplicity of bombs will mean a multiplicity of shots in the sense that any corrections can be made for misses. So far as seagoing aircraft are concerned it is certain that any airplane that can be stowed on a carrier and take off in the length of a flying deck cannot be of a size sufficient to carry more than one torpedo or more than one bomb of a size sufficient seriously to injure a dreadnaught.

Now a military weapon that is out of action after firing one shot, or even one salvo, cannot be classed as an efficient weapon. It is fighting against the most persistent of enemies—the doctrine of mathematical chances.

No other weapon in practical use has this serious limitation. The naval gun, for example, has the most elaborate mathematical devices for finding the range and speed of the enemy and for solving the intricate problem of making curving shell and moving target arrive at the same point at the same instant. Yet with all this no battleship commander would consider it more than a lucky chance to be "on" with his first salvo. Coast defense guns have a stable platform and instruments of much greater precision than those possible afloat. Suppose we compile their target records for ten years to find what percentage of the first or "trial" shots landed on the target. Yet the airplane has only its trial shot, delivered from the most unstable of platforms at a moment to be determined from the

factors of its exact altitude, its own speed and direction, speed and direction of target and wind velocity. One solution only, no corrections allowed.

Mental Hazard.—Airplanes, of course, have target practice and records of their own, but there is a notorious difference between practice and war performance. In the old days a dueling expert could break the stem of a wine glass at twenty paces but found it very different when the glass was replaced by a man with a pistol of his own. The present generation is more familiar with the example of a fullback kicking field goals with mathematical precision before the game and his relative performance when two opposing ends are charging down upon him.

A few weapons, like the bayonet and hand grenade, call for closer contact with the enemy, but no one but an aviator is called upon to make his final estimate and calculation under conditions of such hurried strain and such imminent peril to himself and his mission. If there is any sort of defense in the air he will not only be dodging a pursuit plane armed with a machine gun, but will be wondering whether he can get his bomb off before the next antiaircraft burst will get him. With all the courage in the world and conceding that his anxiety is not for himself but for his success, these conditions are not going to make for accuracy in firing his one uncorrected shot.

Hit or miss, the airplane's usefulness practically ends when that one shot is fired. For that action at least, there is no reloading. Hasty retreat to a distant base is in order. In proportion to the effective force it can expend in one action, the airplane is probably the most expensive weapon devised.

Experience.—All this may seem hypercritical. The future alone can tell. In judging of the future, however, we may avail ourselves of the customary liberty of looking at the past.

As already indicated, the aircraft enthusiast is apt to dismiss all the experience of the World War with the observation that "aviation was in its infancy." We may fairly ask a more critical examination of the failure of air power to exercise any appreciable effect on sea power, except as an auxiliary weapon whose effectiveness is not in dispute. Aviation has not changed in kind since the close of the war, only in degree, and if there was any indication of a beginning along the lines now under discussion its budding promise ought at least to be discernible. It is not.

The principal points which are relied on to support the contention that modern airships must not be judged by those of wartime is that the size and radius of action of airplanes have greatly in-

creased and that they carry much heavier bombs. It happens, however, that Germany had, first and last, over fifty Zeppelins, and that no modern airplane has yet approached these in size, radius or weight of bombs. They proved vulnerable to weather, but as long as they lasted they should have shown what aircraft with plenty of radius and lifting power could do.

The first subject to challenge the attention of a military student is the failure of air power to close the line of communication between England and France. This was well within the radius of German aircraft. Zeppelins bombarded London but were utterly unable, in the slightest degree, to stop the flow of men and munitions across the English Channel. This artery was the most important sea lane of the entire war. "The British Navy," says Admiral Sims, "transported about 20,000,000 souls back and forth between England and France in four years, and in this great movement seaplanes, dirigibles and other forms of aircraft played an important part."*

Here we have a typical instance of sea power, aided by aircraft acting in an auxiliary and defensive capacity, holding open a line so vital that a month's closing would have meant the loss of the war. Against this line Germany threw her underseas weapon without serious effect. Why was her air power spent on inconclusive raids over the adjacent land areas instead of smashing this neck of the bottle with the conclusive ease with which paper air fleets are destroying paper surface fleets in every popular magazine of today?

Except for radius of action, which this sample is chosen to eliminate, the answer must lie in the limitations here discussed. We may speculate at will as to their relative importance, perhaps the defensive aircraft, perhaps the uncertainties of weather, perhaps the effort needed to launch the meagre number of missiles carried.

Certain it is that within practically the same theatre of operations the Germans conducted air raids which were (a) intermittent; (b) at night when air defense could not readily gather; (c) in weather of their own choosing and hence merely occasional; (d) directed against large areas as targets. They failed utterly to solve a far more important problem calling for effort (a) continuous, (b) in daytime when defensive aircraft could see them, (c) in all weather in which surface craft could operate, and (d) with individual ships as targets. If this problem is not as inherently insolvable today as it was then, it behooves the airmen to come down from the clouds long enough to tell us wherein the difference lies.

* Sims. *The Victory at Sea*, p. 323.

Airship against Battleship.—Even upon the narrower issue of airship against battleship the utter failure of the airship under war conditions needs more explanation than has yet been forthcoming. It must be repeated that Germany's monopoly of Zeppelins gave her air fleet a backbone of fighting craft which in the matter of radius of action and weight of bombs were superior to present day airplanes. It must also be remembered that even with increased radius of action not all European apprehension need be shared nor all European practice followed by a nation still separated from possible enemies by 3000 miles of water. The fact now to be pondered, however, is that Zeppelin and airplane alike inflicted no damage on capital ships and very little on other types, even within easy radius.

To one who has seen the chart of the North Sea "sweeps" of the Grand Fleet, such as now hangs in the cabin of the *Hood*, this fact is very striking. Apparently, no attention whatever was paid to the fact that they were often within easy reach of German air bases. As for cruisers and all lighter craft, the entire North Sea was theirs to the limits of the German mine fields off Heligoland and Horn Reef. With aircraft for observation and bombers galore the enemy allowed the British fleet to cruise with impunity within striking distance of their coast.

An individual instance of the failure of wartime experience to measure up to the roseate promises of today is that of the *Konigsberg*. When her raiding activities could no longer be maintained this cruiser was marooned in a shallow river in German East Africa. Here she lay, as helpless as a target ship, with the one exception that she had her antiaircraft guns. The British brought down two seaplanes to bomb her. In the face of the antiaircraft fire they proved unequal to the task. After several attempts one of them crashed into the sea and was wrecked.* Then the admiralty sent down two monitors, and with seaplanes spotting for the indirect fire—just the kind of auxiliary service which all admit is invaluable—the *Konigsberg* was quickly destroyed.†

Jutland.—The culmination of naval fighting was Jutland. If ever sea power needed effective air power to aid it, or if ever air power proposed to demonstrate the beginnings of an ultimate superiority, it was that day. Preliminary plans for Zeppelin observations had gone wrong, owing to unfavorable weather conditions. Admiral Scheer's "list of warships which took part in the battle of the Skagerrak and the operations connected therewith" includes ten Zeppelins. Five of them took the air when the British fleet was first

* Corbett, *Naval Operations*, Vol. 3, p. 8.
†*Ibid.*, p. 66.

sighted. Their achievements are briefly chronicled. "They took no part in the battle that so soon was to follow, neither did they see anything of their own main fleet, nor of the enemy, nor hear anything of the battle."*

The first mention of a Zeppelin by the British was at daybreak after the engagement. Jellicoe's battleships were off Horn Reef, as near the enemy's base as they dared to go on account of mine fields. A Zeppelin was sighted which reported the position of the British fleet to Scheer. Shortly afterwards, when Napier reported that he was engaging another Zeppelin with his cruisers, the British battle fleet, which the day before had turned away from destroyer attacks, went over and helped. The airship disappeared to the eastward and no molesting force came out to show what "control of the air" could accomplish.

At no time during the war did aircraft in touch with enemy fleets function to any degree such as we would now be led to expect. On August 18, 1916, Jellicoe notes: "Zeppelins were frequently in sight from both the battle and the battle cruiser fleet and were fired at, but they kept at too long a range for our fire to be effective." The next day the commander of the Harwich force reported that "his force was shadowed by airships during the whole period of daylight on the nineteenth. * * * It was evident that a very large force of airships was out."†

Offensive Operations.—Allied aircraft were by no means confined to defensive operations. The British had bombers and used them in naval operations. During 1917 Jellicoe reports persistent aerial attacks against vessels at German naval bases in Belgium, but the only victory claimed is that German destroyers found it so uncomfortable that they moved. The location of the German battleships in their harbor was perfectly well known and the whole North Sea was available for the launching of seaplanes on any calm day, but damage to capital ships there was none.

Meanwhile submarines were infesting British coastal waters and were hunted by aircraft as well as by every other kind of vessel. Well within range, observable even when submerged, vulnerable to small bombs and utterly helpless against aerial attack, the total bag to the credit of bombs from British aircraft was probably five.‡

American Experience.—Yankee ingenuity and initiative brought no better results. Admiral Sims has an entire chapter on "Fighting Submarines from the Air," which is instructive reading. Extremely useful as auxiliaries to naval forces, invaluable for scouting and ob-

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* Scheer, *Germany's High Sea Fleet*, p. 141.
† Jellicoe, *The Grand Fleet*, p. 486.
‡ Sims, *The Victory at Sea*, p. 320.

servation, there is not a suggestion that aircraft could be depended on to go out unaided to find the enemy and sink him with bombs.

Here is Admiral Sims' description of the work:

> At the cessation of hostilities we had a total of 500 planes of various descriptions actually in commission, a large number of which were in actual operation over the North Sea, the Irish Sea, the Bay of Biscay, and the Adriatic; our bombing planes were making frequent flights over enemy submarine bases and 2,500 officers and 22,000 enlisted men were making raids, doing patrols, bombing submarines, bombing enemy bases, taking photographs, making reconnaissance over enemy waters and engaging enemy aircraft.*

With all this activity American aircraft were credited with just one submarine destroyed by direct action and one "probably damaged" when Ensign Ives dropped a dud upon it. As Admiral Sims calls this latter "perhaps the most amazing hit made by any seaplane in the war" we need look no further for more material results.

The whole summary of war experience may be quoted from the same distinguished author:

> I have said that the destructive achievement of aircraft figure only moderately in the statistics of the war; this was because the greater part of their most valuable work was done in cooperation with war vessels.†

Which, so far as human prescience goes, will probably be as true tomorrow as it was yesterday.

Conclusion.—Neither in a careful estimate of present day conditions nor in the light of war experience with every allowance for improvements can we discover any warrant for the claim that the airship is likely to put the battleship out of business.

The fundamental reason goes back to the dawn of the history of warfare. The bombing airplane is by nature a raider, designed to deliver its blow and retire. It is, in fact, the most helpless of weapons after it has delivered its shot. By its nature it cannot hold a position once taken, and so is incapable of exercising that steady pressure by which wars are won.

Battleships can take and hold positions. Usually the position is one from which the inferior enemy fleet can be contained, after which cruisers can maintain all lines of communication. If necessary to cut an enemy line of communications a force able to hold its position must be stationed across it.

No raiding operations ever severed a line of sea communications. The French tried it for centuries with their commerce destroyers.. The German submarine came near succeeding, largely

* Sims, *The Victory at Sea*, p. 338.
† Sims, *The Victory at Sea*, p. 321.

through the novelty of the problem to be solved, but development of the defense, notably the depth bomb and the adoption of the convoy system, soon swung the balance. With all its relative disadvantages and special limitations of its own there is no reason to believe that the airplane will succeed where the submarine failed.

Wars, whether on land or sea, will be won in the future as they have been in the past by the comparatively slow but irresistible force which is able to move from one strategic position to another, take it, consolidate it, hold it, and move on the next. On land this force is the infantry, on sea it is the battleship. The airplane is not of this type.

We, as Americans, love, cherish and desire peace to the very limit that peace can honorably be maintained. Yet despite our love for peace, every generation of Americans has unhappily been forced to wage war in order that this country might enjoy righteous and honorable peace. The soldiers of George Washington won our liberties on the battlefield,—their sons were called upon to defend this nation by force of arms in 1812 — their grandsons in 1860 — their great-grandsons in 1898—and their great-great-grandsons in 1917, to mention only four wars which this great peace-loving country has been forced to wage.—*Honorable Dwight F. Davis, Acting Secretary of War.*

The Battles of Ludendorff On the Russian Front*

By GENERAL HUBERT CAMON, *French Army*

Translated by Captain E. M. Benitez, C. A. C., and reprinted by special arrangement with Berger-Levrault, publishers of *Revue Militaire Generale*

BATTLE OF TANNENBERG

AUGUST 26, 27, 28, 29 AND 30

GENERAL Moltke,† in the belief that nothing but cavalry raids were to be feared in East Prussia during the first twenty days after the declaration of war, left only four corps of landwehr and landstrum, which constituted the VIII Army, under command of General von Prittwitz. These troops, resting on the fortified barrier created by the lines of lakes from Angerburg to Johannisburg, were sufficient to cover this province.

The northern gap from Angerburg to the sea, south of the Pregel to the Angerapp, was to be guarded by the I and XVII Corps and I Reserve Corps, and north of Pregel, towards the Deime, by the main Reserve of the Konigsberg garrison.

The southern sector, between Johannisburg and Thorn, was assigned to the XX Corps. This corps, supported by the two mobile corps of the garrisons of Thorn and Graudenz, was to extend itself towards Deutsch-Eylau and protect the railway which supplied the VIII Army.

The German forces numbered about 60,000 men.

On the 15th of August, the 1st and 2d Russian Armies,‡ commanded by General Jilinsky, invaded East Prussia, some time before it had been calculated by the German General Staff. The 1st Army (Niemen Army) consisting of 300,000 men, under command of General Rennenkampf, appeared to the north of the barrier of lakes,

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* In three parts, of which this is the second, the first part having been published in the August JOURNAL.

† TRANSLATOR'S NOTE: General Moltke was, in August, 1914, Chief of Staff of the German Army, and was in direct command of the German forces.

‡ TRANSLATOR'S NOTE: At the beginning of the War, the Russian forces, on the Eastern Front (Russia's Western Front), comprising six armies, were organized into two army groups, operating under the Grand Duke Nicholas as Commander in Chief. The Eastern Front was divided into the Northwestern and Southwestern Front. The 1st army group (Northwestern Front), comprised the 1st Army (Niemen Army), commanded by General Rennenkampf, and the 2d Army (Narew Army), commanded by General Samsonov. Both armies were under the control of General Jilinsky. The Southwestern Group, controlled by General Ivanov, consisted of the 3d Army, General Ruzki; 4th Army, General Salza; 5th Army, General Plehve, and 8th Army, General Brusilov.

while the 2d Army (Narew Army) consisting of 250,000 men, under command of General Samsonov, came up to the south of this barrier.

The left of the German VIII Army was defeated at Gumbinnen and, in order to avoid being surrounded, General von Prittwitz decided to retreat towards the Vistula. It was then that Moltke directed Ludendorff to assume the general supervision of operations, and calling Hindenburg into active service, placed him in command of the VIII Army.

While going through General Headquarters at Coblenz, Ludendorff desiring by all means to make the lines of communications of the VIII Army sure, telegraphed the General Staff of this Army, ordering the movement of the I Corps to the south of the XX Corps, in order to effect junction with it.

August 23.—On August 23d, at 2 p. m., Hindenburg and Ludendorff arrived at Marienburg, where they were shown by the General Staff of the VIII Army, the plan of operations of General Jalinsky, who commanded the Russian Group, composed by the 1st and 2d Armies. This plan was found in possession of a captured Russian officer.

"The Army of Rennenkampf," writes Hindenburg, "winding around the Masurian lakes on the north was to advance against the Insterburg-Angerburg line. It was to attack the German forces presumed to be behind the Angerapp, while the Narew Army was to Cross the Lotzen-Ortelsburg line to attack the Germans in flank. The Russians were thus planning a concentric attack against the VIII Army, but Samsonov's Army was already extended farther west than was originally intended."—Hindenburg, "Out of My Life."

August 24.—Generals Ludendorff and Hindenburg arrived at Tannenberg, close to General Scholtz who commanded the XX Corps.

The plan of General Jilinsky was as follows: While Rennenkampf was holding off the VIII Army, Samsonov would come up on the rear of this army by the railway Rastenburg-Seeburg. The 1st and 2d Armies would effect their junction to the northeast of Rastenburg.

With some minor delays, the bulk of Samsonov's Army had crossed the frontier from the 21st to the 22d of August. This army was already greatly exhausted, having crossed Poland by forced marches. Its equipment advanced very slowly along the sandy roads, and consequently the supply of the army was uncertain. Nothing could be found in this territory, and by this time, both

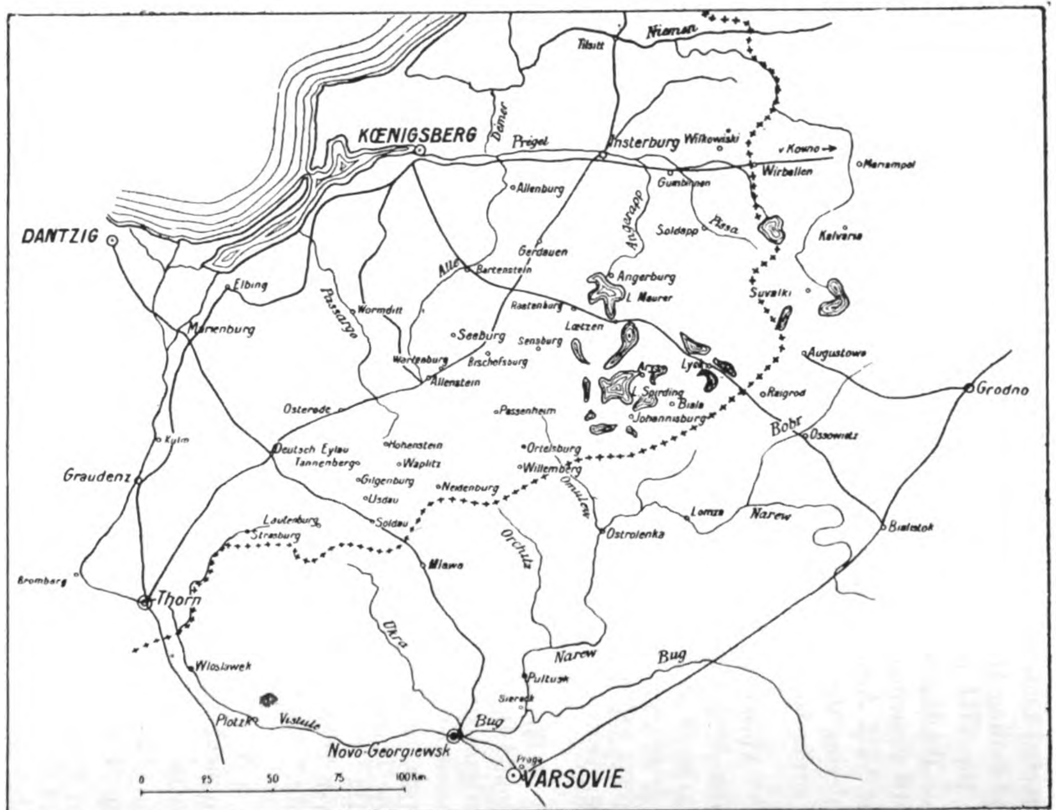


Fig. 8. Map of East Prussia

bread and forage were scarce. Samsonov's Army advanced along a front of 100 kilometers, in the following order from left to right: 23d, 13th, 6th and 2d Corps,* with the cavalry at the flanks. After having crossed the frontier, the 2d Corps of the Narew Army was attached to Rennenkampf's Army, and replaced by the 1st Corps, which after Novo Georgiewsk was to take its place at the left of the 23d Corps.

Samsonov was trying to push his left towards the Novo-Georgiewsk-Mlawa-Soldau railway. He was camped in this locality, when he perceived the rapid retreat of the Germans, at the most propitious moment for cutting off their retreat.

The support of his left, as above mentioned, was to bring about an extension of front that would cut off all liaison with the 1st Army.

"Instinctively," writes Ludendorff, "the idea of profiting by the separation of the two armies came to the minds of our General Staff.

"We shall only make a screen demonstration against Rennenkampf and will concentrate all our forces against the most dangerous army, that of Samsonov, who contemplates an enveloping attack."

The tactical disposition of the battle was not a sudden conception of Ludendorff.

"The conception of the battle," he says, "was gradually formed during the period of August 24th to 26th. The military profession has become an art, and in a battle of mobile warfare, events take place very rapidly and we must keep this fact foremost in our minds."

In regard to the VIII Army, Ludendorff had already issued orders while going through Coblenz, to halt the retreat of the XVII Corps and I Reserve Corps and the Main Reserve of the Konigsberg garrison, which should hold their lines. The 1st A. C. was to be detrained, south of the XX Corps, somewhere in the Deutsch-Eylau region.

Any available troops from the garrisons of Thorn, Kulm, Graudenz and Marienburg, all of which were landwehr and landstrum, were to go tq Strassburg and Lautenberg.

"Thus," writes Ludendorff, "a strong group was formed in the southwest part of Prussia, while the Northern Group, either continued its retreat in a southwesterly direction, or could be brought straight down south to assist in the action against the Narew Army.

* Less one division (3d Guard Inf. Division), kept in reserve at Augustowo, and which was not to participate in the battle.

Of course, an actual decision as to the plan to be adopted could only be made on the spot.

"The great question was whether or not it would really be possible to withdraw the I Reserve Corps and the XVII Army Corps from their positions facing Rennenkampf, so as to unite them with other units of the VIII Army for a blow against the Narew Army. It depended solely upon Rennenkampf himself, for if he knew how to make the most of his success at Gumbinnen and advance quickly, my plan would be unthinkable. In this case, there would be no alternative but to withdraw the I Reserve Corps and the XVII Army Corps in a more southwesterly direction towards Wormditt, while the other part of the VIII Army held up the Narew Army, and prepared to check it if occasion served.

"We gradually discovered that Rennenkampf was advancing very slowly. As a consequence, the two army corps which were retreating on the line Bartenstein-Gerdauen, could, therefore, be gradually deflected in a sharp southwesterly direction towards Bischofsburg-Neidenburg. Only the First Cavalry division remained facing Rennenkampf, and on the 26th the First Cavalry brigade of this division received the order to move on Sansburg via Rossel. After August 27th, only two cavalry divisions stood between Lake Mauer and the Pregel, facing twenty-four strong infantry divisions, and several cavalry divisions of Rennenkampf's Army."—Ludendorff, "My War Memories, 1914-1918."

It was truly certain that further economy of forces could hardly be attained.

"The I R. C. and the XVII Corps were marching in the rear of the Narew Army from Neidenburg to Allenstein. In this way they exposed their rear, without adequate protection, to Rennenkampf's Army, which was only two or three days' march away. When the battle began in real earnest on the 27th, and in contrast to previous wars, was not finished in one day, but continued until the 30th, Rennenkampf's formidable host hung like a threatening thunder-cloud to the northeast. He need only have closed and we should have been beaten. Few knew the anxiety with which I watched the Niemen Army during those long days."—Ludendorff, "My War Memories, 1914-1918."

The Plan of Battle Becomes Precise.—On the 24th,* Ludendorff learned from an intercepted enemy wireless message, Samsonov's dispositions for the advance of the 26th. The Russian Army was extended from Soldau to Bischofsburg, a distance of nearly 100 kilometers, while the I Army Corps marched from Mlawa towards

* Note: Ludendorff writes: "On the journey from Marienburg to Tannenberg * * *," which implies that it was on the 24th.

Soldau protecting the western flank, at a distance of from 25 to 30 kilometers from the 23d Corps, which was its right neighbor.

"The Narew Army was advancing," writes Ludendorff, "in echelons, with its right wing in the lead, its 6th Corps directed via Ortelsburg on Bischofsburg, which was reached or passed by the 26th, and its 13th Corps directed from Neidenburg through Passenheim on Allenstein. The 15th and 23d were following. On the 26th, the most southerly echelon was to be found somewhere near Waplitz. Still further back to the left, and pushing west, the 1st Corps, covered by several cavalry divisions, was moving through Mlawa and Soldau, against Lautenberg and Strasburg. It was a question of breaking up this movement of the enemy by an attack from the west with the Southern Group of the VIII Army. It was a great temptation to attack simultaneously south of Soldau, in order to surround the 1st Russian Corps as well. The defeat of the Narew Army could thus have been absolutely annihilating, but the forces at my disposal were insufficient."—LUDENDORFF, "My War Memories, 1914-1918."

Let us now see the plan of battle as outlined by Hindenburg:

"In the first place we opposed a thin centre to Samsonov's solid mass. This centre (the XX Corps), might bend under the enemy's pressure, but it would not break, and while it was engaged, two important groups on its wings were to carry out the decisive attack. The troops of the I Corps, reinforced by Landwehr, were brought for the battle from the right, the northwest, the troops of the XVII Corps and the I Reserve Corps, with a Landwehr brigade, from the left, the north and the northeast.

"At the extreme right, General von Muhlmann, subordinated to the Commander of the I Corps, protected the left flank of this corps against enemy cavalry with troops withdrawn from the fortified garrisons of the Vistula."—HINDENBURG, "Out of My Life."

Thus, according to Hindenburg, the battle against Samsonov's Army was planned on the scheme of the battle of Cannae. Ludendorff's plan was not so ambitious. He considered the Narew Army too large a mouthful for the forces at his disposal. As the First Russian Army Corps was totally separated from the others, Ludendorff wished to profit by this circumstance and crush this corps first of all. He intended then to plan a battle along the scheme of Cannae, against the bulk of Sansonov's Army.

"So I proposed to General von Hindenburg that an attack be made in the direction of Usdau by the I Corps on the line Deutsch-Eylau-Montowo, and by the right wing of the reinforced XX Corps from the direction of Gilgenburg, so as to throw back the Russian 1st Corps to the south, beyond Soldau. Then our I Corps was to

break through in the direction of Neidenburg, in conjunction with I and XVII Corps and I Reserve Corps, in order to surround, at least, the main body of the Narew Army."—LUDENDORFF, "My War Memories, 1914-1918."

AUGUST 26.—Ludendorff concentrated the I Corps (Francois) coming up from the south and half of the right of the XX Corps, reinforced by the 3d Reserve Division, coming up from the north, against the First Russian Corps, at Usdau.

In the meantime, the other half of the XX Corps, reinforced by von der Goltz' landwehr division, which had come from Schleswig-Holstein and had taken position at the left of that corps, was to hold off the bulk of Samsonov's Army. Usdau was captured in the morning by the I Corps, and the Russians were pushed as far back as Soldau.

ENVELOPMENT OF THE MAIN BODY OF SAMSONOV'S ARMY.—On the 26th, the I Reserve Corps (von Below), coming from the north had reached the Seeburg region. The XVII Corps (Mackensen), at the left of the I Reserve Corps, had attacked a division of the 6th Russian Corps, repulsing it towards Bischofsburg. The VI landwehr brigade that had advanced to the northwest of Bischofsburg, participated in the above combat.

AUGUST 27.—The I Reserve Corps reached Wartenburg on the evening of this day, and the 6th Russian Corps forming the right of Samsonov's Army, was now in full retreat in front of the XVII Corps. The bulk of this corps camped near Mensguth on that evening.

At the centre, the XX Corps greatly weakened by these attacks, could not advance. On the 27th the situation was as follows:

The 6th Russian Corps was retreating in great disorder in front of the I Reserve Corps and the XVII Corps. The Russian positions at Usdau had been taken by the I Corps. The Russian Corps of the centre,—23d, 15th and 13th,—continued their advance towards Allenstein and Gilgenberg, and were getting deeper and deeper in Ludendorff's net, in which they were eventually to be caught.

"Now, when the enemy's centre pushed forward farther towards Allenstein-Hohenstein, it was no longer victory but destruction that lured it on. For us the situation was clear. On the evening of this day we gave orders for the complete encirclement of the enemy's central mass."—HINDENBURG, "Out of My Life."

These orders were as follows: The I Corps (von Francois) was to seize Neidenburg; on the left, the I Reserve Corps and the XVII Corps (Below and Mackensen respectively), giving up the pursuit of the remnants of the 6th Russian Corps were to descend towards the southwest on Allenstein (occupied by the 13th Russian Corps) and Passenheim, and were to seek cover towards Ortelsburg. At the centre, the XX Corps was to vigorously push ahead, while von der Goltz' landwehr division was to attack Hohenstein.

Thus, while the XX Corps and von der Goltz' division were holding off the Russian central mass, composed of the 23d, 15th and 13th Corps, the two German wings, effecting their junction to the west of Willenberg, would close the circle in rear of these Russian forces.

August 28.—During the morning of this day, the situation of the VIII Army was very delicate. The right wing (I Corps), had captured Neidenburg, but the centre had made no progress. Thus, although the two flanks had succeeded in advancing, the centre was running the risk of being pierced.

"The situation at this point might have become dangerous and a grave crisis might have resulted, if the enemy had attacked with his concentrated forces. At the best, the battle would have been prolonged. Finally, Rennenkampf might have continued his march. But the enemy made no attack on the 41st Division and the Niemen Army did not march. During the afternoon, the situation changed to our advantage. The 3d Reserve Division, and later the 37th Infantry Division gained ground west of Hohenstein; von der Goltz' landwehr division entered Hohenstein itself. The enemy front appeared to be wavering. Towards the evening, we were not at all clear as to how things stood with the individual units; but there was no doubt that the battle was won. *Whether it would prove a real Cannae was still uncertain.* The I Corps had to send a detachment to Willenberg, whither the XVII Corps was also to proceed. The retreat of the Russians was to be cut off.

"During the night we learned further details. The Russian 13th Corps had advanced from Allenstein on Hohenstein, and had pressed the landwehr severely. The I Reserve Corps had come down southwest of Allenstein. Its further advance would close around the Russian 13th Corps and thus conclude the whole operation, whilst the I and XVII Corps cut off the retreat of the other portions."—Ludendorff, "My War Memories. 1914-1918."

August 29.—On the morning of the 29th, Ludendorff was informed that while the I Corps was advancing towards Willenberg to

complete the encircling ring, a Russian Corps coming from the north had appeared at its rear, to the southwest of Allenstein.

All the available forces were immediately dispatched towards Neidenburg, but General Francois, commander of the I Corps, pulled himself out the difficulty.

Ludendorff then thought of withdrawing the I Reserve Corps and the XX Corps in order to have both of them available for any unforeseen attack.

AUGUST 30.—"On August 30, the enemy concentrated fresh troops in the south and east and attempted to break our encircling ring from without. From Myszaniec, that is, from the direction of Ostrolenka, he brought up new and strong columns to Neidenburg and Ortelsburg against our troops, which had already completely enveloped the Russian centre and were therefore presenting their rear to the new foe. Francois and Mackensen sent their reserves to meet the new enemy. Against their resistance the attempt to mitigate the catastrophe to Samsonov came to naught."—HINDENBURG, "Out of My Life."

On the 31st, Hindenburg sent the following report to the Kaiser:

"The ring around the larger part of the Russian Army was closed yesterday. The 13th, 15th and 23d Army Corps have been destroyed. We have already taken more than 60,000 prisoners, among them the Corps Commanders of the 13th and 15th Corps. The guns are still in the forests and are now being brought in. The booty is immense though it cannot yet be assessed in detail. The corps outside our ring, the 1st and 6th, have also suffered severely and are now retreating in hot haste through Mlawa and Myszaniec."

General Samsonov committed suicide and was buried unrecognized not far from Willenberg.

The final number of prisoners was 90,000, according to Hindenburg. The Russian losses in killed and wounded were also very heavy. The Germans then proceeded to give a name to this battle.

"At my suggestion, the battle was named the Battle of Tannenberg, in memory of that other battle long ago in which the Teutonic Knights succumbed to united Lithuanian and Polish hosts."—LUDENDORFF, "My War Memories, 1914-1918."

It was rather a delayed revenge of the Teutons over the Slavs.

"One of the most brilliant battles in the history of the world has been fought. It was a glorious triumph for the generals and their troops, indeed, for every officer and man, and the whole country," modestly writes Ludendorff in War Memories, forgetting to thank

Rennenkampf for his immobility and neglecting to mention the great luck which he had in obtaining a secret code which enabled him to read the Russian radiograms like an open book.

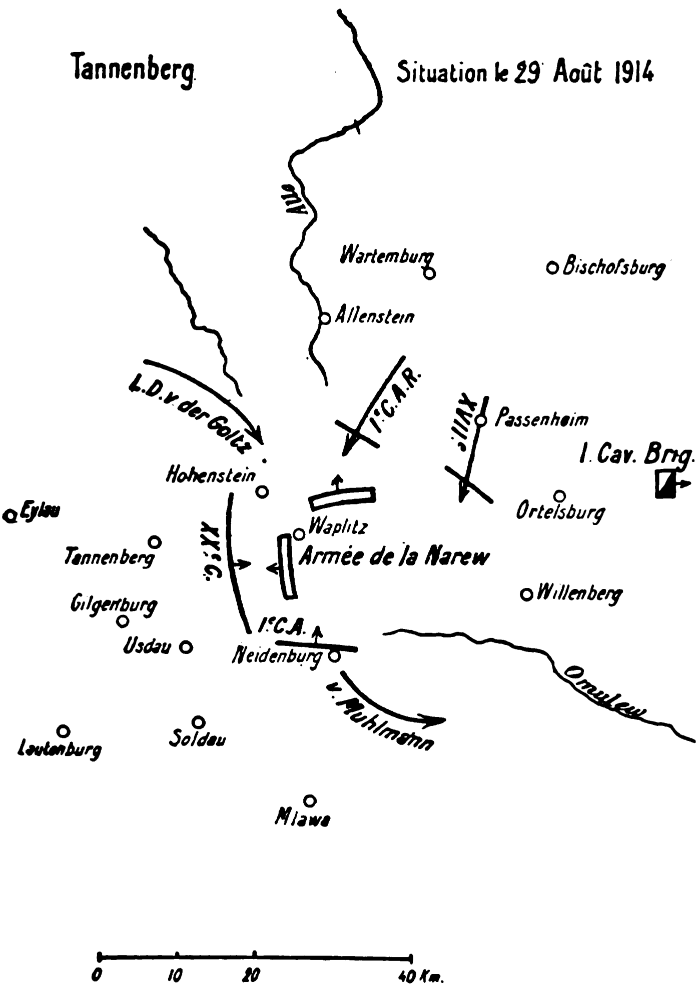


FIG. 9. THE BATTLE OF TANNENBERG [SITUATION AUG. 29, 1914]

"We were proud of this battle. The victory had been brought about by a break-through, an encircling movement, firm resolution to win and intelligent limitations of aims. Despite our inferiority on the Eastern Front, we had succeeded in assembling on the battlefield a force nearly as strong as that of the foe. I thought of General Count von Schlieffen and thanked him for his teaching."—LUDENDORFF, "My War Memories, 1914-1918."

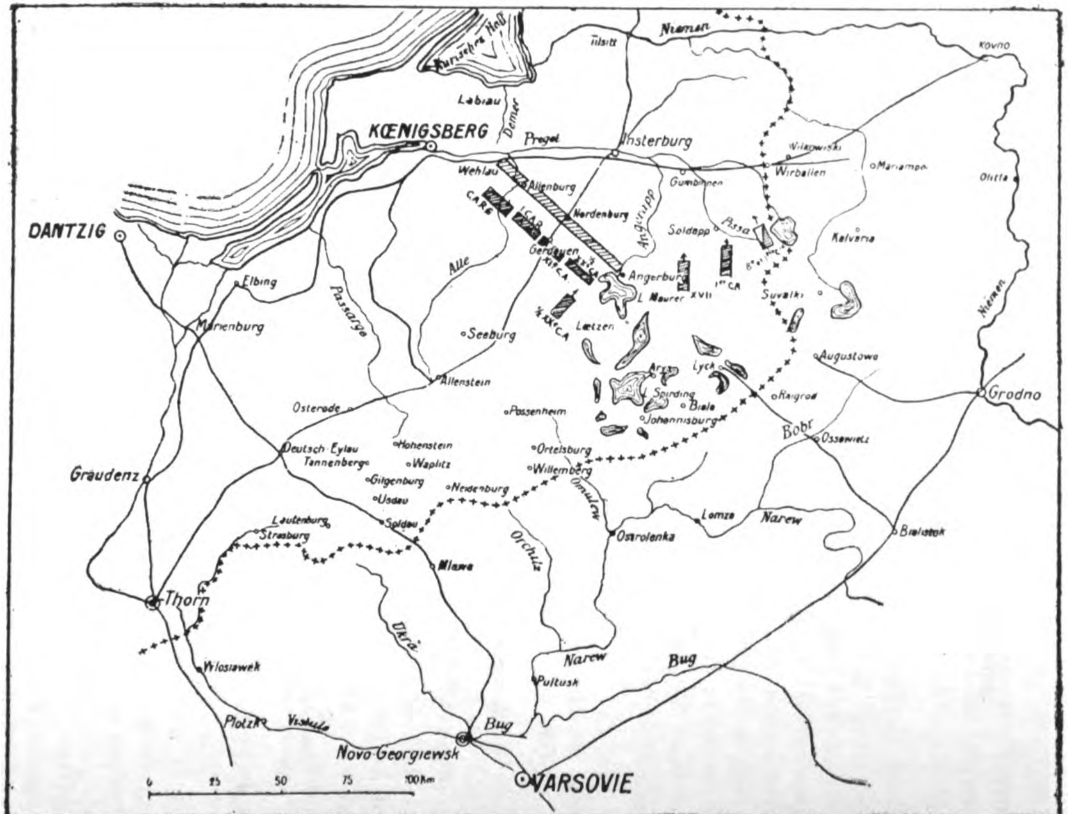


Fig. 10. The Battle of The Masurian Lakes or Insterburg [Sept. 8-15, 1924]

This was the first battle on the Eastern Front in which Hindenburg and Ludendorff had participated. As a matter of justice, the audacity of the decision and the prudence in the execution deserve praise. The Narew Army was not enveloped in its entirety, because the 1st and 6th Corps which were the first ones to be attacked were thrown outside the circle which enclosed the 23d, 15th and 13th Corps. The results obtained by the scheme of Cannæ, favored by Schlieffen, were superb. Both Hindenburg and Ludendorff confess that they spent uneasy hours during the five days of battle.

The conduct of the Russian Command is puzzling. It is said that Rennenkampf was at the time with his cavalry and could not be located on time. But where was General Jilinsky, the Commander of the Army Group made up by the armies of Rennenkampf and Samsonov? The inactivity of the Niemen Army must be accounted for by the intentions of the Russian G. H. Q. of not using hurriedly mobilized troops in defensive operations. The Russian General Staff thought, without doubt, that by invading Eastern Prussia, the mission of helping the French Army had been accomplished. It did not want to expose the great contemplated maneuver with all the Russian forces unnecessarily, by engaging the two armies of the North. This is the only explanation for Rennenkampf's concern in reorganizing a strong defensive position between the Pregel and the lakes, prolonged to the north by the line of the Deime to Labiau.

If this is the true explanation, then it was Samsonov, who carried away by his first successes, went beyond his instructions and that was why he committed suicide when he saw that his defeat was imminent.

We now quote some extracts from the book of M. Paleologue, the French ambassador at St. Petersburg, which throw some light on the operations on the Russian side:

"AUGUST 24.—Our operations on the Belgian and French Fronts have taken a bad turn. I received orders to appeal to the Imperial Government in order to accelerate the Russian offensive as much as possible. I visited the Ministry of War and energetically pressed the request of the French Government."

On the 26th, M. Sazonov, the Minister, informed the French Ambassador, M. Paleologue:

"General Jilinsky, the Commander in Chief of the Northwestern Front, considers that an offensive in Eastern Prussia is doomed to fail, because our troops are too scattered and transportation is very difficult. (The Masurian region is covered with forests, rivers and

lakes.) General Yannouchkewitch, Chief of Staff, is also of the same opinion and greatly discourages the offensive. But General Danilov explained not less forcibly that we had no right to let our Allies perish, and that in spite of the unavoidable risks of the enterprise, we should attack without delay. The Grand Duke has just decided to carry out this plan.

"Under the imperative and repeated orders of the Grand Duke, the five Corps of General Samsonov attacked the enemy day before yesterday (August 26) in the Mlawa-Soldau region. The point of attack was well chosen and will compel the Germans to divert large forces to this region. A Russian victory in the direction of Allenstein would have the double result of opening the route to Danzig, and also of cutting off the retreat of the German Army which has just been defeated at Gumbinnen."

THE BATTLE OF THE MASURIAN LAKES OR INSTERBURG

September 8-15, 1914

On August 30, after the battle of Tannenberg, General Conrad* requested Hindenburg to effect a general offensive in the direction of Warsaw, for the relief of the Austro-Hungarian Armies.

First of all, however, it was necessary to dispose of Rennenkampf, because his army might advance through Allenstein against the rear of the VIII Army.

On August 31st, Hindenburg was informed that two corps from the Western Front, the XI Corps and the Guard Reserve Corps and the 8th Cavalry division were on the way to Eastern Prussia to assist in driving Rennenkampf out of this province, and after this to immediately take the offensive against Warsaw.

"Rennenkampf had apparently withdrawn his advanced units several kilometers, but he seemed to intend a stand between the river Pregel and Lake Mauer. The VIII army was compelled to fight a second battle, and had to use all its available strength. In the execution of this plan, the reinforcements from the west were detrained on the Allenstein-Elbing line, and the VIII Army was concentrated ready to advance between the Willenberg and Allenstein Front. Only small forces were left behind for the defense of the frontier near Soldau. They were to advance into Poland in the direction of Mlawa.

"As soon as the troops had been concentrated, we intended to attack Rennenkampf on a wide front between the river Pregel and

* Translator's Note: General Conrad was Chief of Staff of the Austro-Hungarian Army.

Lake Mauer, while enveloping his left beyond Lotzen and further south."—LUDENDORFF, "My War Memories, 1914-1918."

A flanking corps was to advance towards Lyck, in order to "guard the army from attack from Augustowo and Osowiec, where we expected hostile forces to detrain."

"The operation also was extraordinarily daring. To begin with, the Russian Neimen Army, with its twenty-four infantry divisions, was very much stronger than the VIII Army, with its fifteen to sixteen divisions. Moreover, the Russian divisions consisted of sixteen battalions, and ours, at that time, of twelve. The Russian fighting strength was further increased by from four to six divisions, which were being assembled around Osowiec and Augustowo. This immense superiority could be concentrated against us at any moment and at any chosen point. Our right wing, in particular, was in danger to the east of the lakes. It might be overwhelmed. Even in such a situation as this, we did not hesitate for a moment to venture on a battle. Our superior training was in our favor. Tannenberg had given us a great advantage."—LUDENDORFF, "My War Memories, 1914-1918.

"We did not know," writes Hindenburg, "what forces the enemy had to catch us by surprise in the region southeast of the Masurian lakes. Rennenkampf had doubtless received reinforcements. The Russian reserve divisions from the interior were now ready to take the field. Would these units be sent to Rennenkampf or brought up near him, either to give him direct support or to strike at us from some unexpected quarter?"

Rennenkampf, however, intimidated by Samsonov's defeat, abandoned all thoughts of an offensive. He took position between the Kurisches Haff and the region of the lakes, so as to close the route to the VIII Army

His front of nearly 80 kilometers, followed the Deime to Pregel to Allenburg, thereby obstructing the interval between Allenburg and Angersburg and cutting the railway Thorn-Insterburg, perpendicularly. Further to the south, the Russians also occupied the line of lakes.

Ludendorff with only sixteen divisions wanted to attack Rennenkampf who besides having twenty-four infantry divisions was moreover strengthened by strong positions along this organized 80-kilometer line, which extended as far as the line of the lakes. With such unequal forces, the Germans could not fight a battle of Cannae, using two enveloping masses, but Ludendorff conceived another plan.

Holding off the Russians along the entire front, he would launch a turning attack at Lotzen (region of the lakes), against the rear

of the Russian left and in the general direction of the Insterburg-Wirbatten road and railroad, which constituted the lines of supply and retreat of the Russian Army.

This turning mass would compel Rennenkampf to either evacuate his position or to withdraw forces from his left wing in order to oppose it, thus weakening his left. Ludendorff would then be ready for the break-through.

"On the 5th of September," writes Hindenburg, "the plan of attack against the Niemen Army was definitely decided upon.

"Four corps (the XX, XI, I Reserve and Guard Reserve) and the troops from Konigsberg—comparatively a strong force—advanced against the enemy's front on the Angerburg-Deime line. Two corps (the I and XVII) were to push through the lake region. The 3d Reserve Division, as the right echelon of our enveloping wing, had to follow south of the Masurian lakes, while the 1st and 8th Cavalry Divisions had to be held in readiness behind the main columns, to range at large as soon as the lake defiles were forced. Such were the forces against Rennenkampf's flank. So the scheme differed from the movements which had led to the victory of Tannenberg. This grouping of our columns was imposed upon us by the necessity of securing ourselves against Rennenkampf's strong reserves."

This was Napoleon's normal plan of battle, and it may be briefly analyzed as follows: A front strong enough to check the enemy, *neutralizing and compelling* him to use his reserves; a *turning mass* against the rear of the enemy left flank behind which lay the line of retreat; a break-through mass, in front of the enemy left, which would also serve as general reserve. This break-through mass was, however, too weak. It consisted of only one division of the XX Corps, which was due to disappear immediately at the urgent calls of the XX Corps Commander, which Ludendorff was bound to heed.

"We would have liked," writes Ludendorff, "the right wing to have been stronger, and a division of the XX Corps, west of the lakes, has been kept ready to be placed at our disposal. But this division had to be returned to the Corps. The front of fifty kilometers, on which the four corps attacked the enemy, was certainly very long. Further, the staff of the Guard Reserve Corps, fearing a Russian attack, had therefore concentrated its units. The north wing had to stand firm on the Pregel, otherwise the VIII Army might be outflanked there. The attack of the enveloping wing must not be stronger than we had allowed for. We had to wait and see whether our main attack would succeed or fail. Hard fighting would be the

decisive factor here. We could only do everything in our power to secure the success at which we aimed."

After reading these lines, it can be seen that Ludendorff intended to strengthen the turning mass with troops withdrawn from the front, after the Russian resistance at this front had decreased.

"The enemy positions," writes Ludendorff, "were strong and skillfully organized."

THE BATTLE.—On September 6th and 7th, the VIII Army deployed in front of the Russian position. Large Russian forces were discovered at Insterburg and at Wehlau on the Pregel, and still larger forces to the north of Nordenburg, that is to say, at the centre of the position. They remained stationary and did not interfere with the deployment of the German Corps, which began a methodic attack against the Russian lines.

SEPTEMBER 7.—The turning mass, passing by the fortress of Lotzen, assaulted the barrier of the lines of lakes. Further to the south, the 3d Reserve Division, after a brilliant combat at Biala, crushed one-half of the 22d Russian Corps.

SEPTEMBER 8.—"We were entering upon the crisis of our new operations. The next few days would show whether Rennenkampf intended to attempt a counterattack. Our frontal attack made no progress, but things went better on our right wing. In that quarter two corps had broken through the enemy's lake defenses and were turning north and northeast. Our objective was now the enemy's line of communications. Our cavalry appeared to have an open road in that direction."—HINDENBURG, "Out of My Life."

SEPTEMBER 9.—The battle continued in all its fury, without appreciable results, on the front from Wehlau to Angerburg. On the contrary, the turning mass advanced to the east of the lakes, but the two cavalry divisions could not break an unexpected resistance with all the desired rapidity.

The 3d Reserve Division, which was the echelon of the turning mass, defeated a stronger opponent at Lyck, and thus relieved Ludendorff's anxiety on the south.

SEPTEMBER 10.—Hindenburg and Ludendorff were anxiously awaiting for the disclosure of Rennenkampf's plan, when on the night of the 9th to the 10th, patrols discovered that the Russians had evacuated Gerdauen.

"The report seemed to us incredible. It was only about midday that we were compelled to accept the improbable and *undesirable* fact. The enemy had actually begun a general retreat, even though he offered a stout resistance here and there, and indeed threw heavy columns against us in disconnected attacks. It was now our business to draw the corps and cavalry divisions on our right wing sharply northeast, and set them at the enemy's communications with Insterburg and Kovno."—HINDENBURG, "Out of My Life."

Ludendorff, in turn, writes:

"On the morning of September 10th, we received the decisive news that during the night the enemy had evacuated his position facing the I Reserve Corps north of Gerdauen, probably in consequence of the continuous attacks of the I and XVII Corps. It was said that the corps had occupied their position, and intended to march on. The rejoicing at Headquarters can be imagined. A great success had once more been achieved, but still nothing decisive. The Russian Army was not yet beaten by any means. Northeast of Lotzen we had only local successes. It was important to carry out a frontal attack with all our strength and throw ourselves on the receding enemy, while the enveloping wing advanced east of the plains of Rominten towards the Wirballen-Kovno road. In this way we intended to drive the Russians as far as possible towards the Niemen.

"It had also to be taken into account that Rennenkampf, who was now cooperating with the reinforcements arriving further south, would be able to make a vigorous attack in any direction. Our lines were very thin everywhere, though the two northern groups, which had hitherto been separated by Lake Mauer, had joined up again. The situation was still extremely critical, and the tension was great." LUDENDORFF—"My War Memories, 1914-1918.

Before following the VIII Army in its pursuit against the Russians, let us stop for a moment for discussion of the battle proper.

The news of the evacuation of the Russian positions north of Gerdauen filled Ludendorff with great joy. "The rejoicing at Headquarters can be imagined," he writes, and then continues, "but still nothing decisive. The Russian Army was not yet beaten by any means. Northeast of Lotzen we had only local successes."

Hindenburg, with habitual frankness, writes in turn: "It was only about midday that we were compelled to accept the improbable and *undesirable* fact."

In spite of numerical inferiority, Hindenburg and Ludendorff feeling confident of Napoleon's scheme, hoped to encircle Rennenkampf to the south of Insterburg.

This operation failed due to the Russian retreat. The advance of the turning mass, which "could not be further strengthened until we learned how the combat at the front was succeeding," was sufficient to cause Rennenkampf to retreat, but was not sufficient to encircle him.

Since the corps at the front could not hold out and retain the enemy, the Napoleonic scheme did not *make its full effects felt*, but it caused Rennenkampf to retreat. It was necessary to take advantage of this and inflict all possible damage.

THE PURSUIT. SEPTEMBER 11.—The Corps of the Niemen Army were retreating in three close columns. They moved slowly and to cover the retreat, Rennenkampf engaged important forces. On the 11th of September, bloody combats were taking place all along the front from Goldap to the Pregel.

The German troops were formed in as many columns as there were roads They had orders to maintain strict liaison between them and to press the enemy to the utmost. If the enemy was in position, they were to wait the neighbor's columns before attacking.

"These movements did not turn out quite as I had hoped. Friend and foe were difficut to distinguish. Our own columns fired on one another. The troops made too vigorous frontal attacks, and did not wait the cooperation of neighboring columns. But the most serious difficulty was caused by the fact that on September 11th the XI Corps thought it was being attacked by a very superior force. This was quite conceivable and had to be taken into account. Under the existing conditions as regards the strength of the two forces, the front line required the close tactical support of the enveloping Corps. We had, therefore, to decide to bring the XVII and the I Corps further north than was originally intended. After a few hours the belief of the XI Corps proved to be unfounded. But the order had already been given to the enveloping wing. Later, the Corps were again diverted to their original route, but by then at least half a day had been lost"—LUDENDORFF, "My War Memories, 1914-1918."

Thus, through the fault of the XI Corps, the net was tightened instead of having been enlarged, and this permitted the escape of part of Rennenkampf's forces.

The German troops of the north reached Insterburg on the 11th, while at the south, the 3d Reserve Division entered Suwalki. The southern flank of Rennenkampf's Army barely escaped the envelopment of the I Corps south of Stalluponen. As the northern encirclement was not contemplated any further Ludendorff with-

drew the Guard Reserve Corps from the, pursuit in order to have it ready for any eventuality.

SEPTEMBER 13.—On this date, the German Corps reached Eydtkunen (frontier station on the line Insterburg-Kovno) and used their machine guns against the retreating Russian forces.

"Unfortunately," writes Hindenburg, "we did not reach the great main road from Wirballen to Wylkowyszki this day. The enemy knew that this would spell annihilation to many of his columns which nothing could now stop. He therefore scraped together everything he had in the way of battle-worthy units and threw them against our exhausted troops south of the road."

The battle actually ended on the 13th.

SEPTEMBER 14.—On the 14th, Rennenkampf's troops dissappeared in the marshy and wooded region, situated west of the Niemen between Olita and Kovno. The VIII Army could not pursue them there.

SEPTEMBER 15.—On the 15th the battle of the Masurian Lakes, socalled by the Kaiser, ended in Russian soil, after a pursuit of more than 100 kilometers, which the veteran German Corps covered in four days in spite of the combats and fatigue.

Outside the great battlefield, the 3d Reserve Division (General von Morgen) and the landwehr division of von der Goltz, that were protecting the right flank, fought successfully against forces numerically greatly superior, at Bialla. The landwehr division was held up at Ossowitz, while the 3d Reserve took Augustowo and Suwalki after heavy fighting.

Hindenburg and Ludendorff arrived at Insterburg on the 14th.

"We took lodging at Dessauer-Hof, where Rennenkampf had established his General Headquarters. Not long ago, the Grand Duke Nicholas himself had abandoned the village."

RESULTS OF THE BATTLE.—"While at Tannenberg we took over 90,000 prisoners, we could now only count 45,000.

"The results of the battle were not as striking as those of Tannenberg. There were no operations in the enemy's rear, for they were not possible. The enemy did not make a stand, but withdrew, so that it could only be forced back still further by frontal and flanking attacks. The Russian Army, threatened by an envelopment, recrossed the Niemen in disorder. It could not be considered for

weeks to come as first class fighting material, unless the Russians should reinforce it with fresh troops."—LUDENDORFF, "My War Memories, 1914-1918."

Ludendorff, desiring to influence the judgment of posterity, has written:

"The battle of the Masurian Lakes has not received the recognition it deserves. It was a decisive engagement, ambitiously planned, and carefully executed against an extraordinary numerical superiority. It was attended with grave risks, but the enemy did not realize his strength. He did not even attempt to fight it out, but withdrew so very hastily that, under our pressure, the retreat assumed the character of a flight."

In justice, Hindenburg and Ludendorff may glory themselves in having carried out Napoleon's scheme and of having attained such results as we have mentioned with sixteen exhausted divisions against the twenty-four divisions of Rennenkampf which would not accept combat.

"Freedom, independence, self-government, are all opposed to anything that resembles a mercenary force. But while military science has advanced to such a degree that it is necessary constantly to maintain a considerable body of trained experts in that profession, the true spirit of American institutions requires that each citizen shall be potentially a soldier, ready to take his place in the ranks in time of peril, either in the field or in the necessary productive activity. * * * It is exactly because we wish to keep our standing forces small that the average citizen must give some time to military affairs, precisely as he gives some attention to other government affairs, in order that he may express a deliberate and informed judgment at the ballot box."—*President Coolidge.*

PROFESSIONAL NOTES

The Spiral Method of Unilateral Observation for Adjustment of Fire on Fixed Targets

By MAJOR G. F. MOORE, C. A. C.

The method described below for adjustment of fire on fixed targets by unilateral observation was discovered by Colonel S. C. Vestal, Coast Artillery Corps, while in command of the 339th Field Artillery. During the training period of this regiment in 1917-18 the thought occurred to him that some method should be available which would be much more simple than the methods in use, and by application of which more rapid adjustment could be secured, thus saving time and ammunition. In observing the firing problems from an observation post it became apparent to him that if the observer would place the intersection of the cross wires of the observing instrument on the base of the target the terrain would be divided into four quadrants. By noting the quadrant in which the shot fell the observer would be able to furnish the battery commander with definite information as to whether the point of impact was "over," "short," "right," or "left," with respect to the gun position.

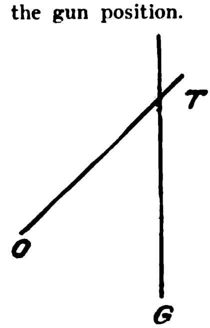


FIG. 1

Before explaining the use of this method of observation of fire a brief explanation of the use of unilateral observation, Case I and Case II, will be given. Comparison with these two standard methods is desired. Unilateral Observation Case I is used when the angle Gun-Target-Observer is from 100 to 300 mils (Fig. 1). The observer gives to the battery commander certain information as to the fall of a shot with reference to the OT line, or the target, as seen from O.P. In other words he will sense the burst as "right" or "left," a definite amount, and when the burst occurs close enough to the OT line to be within the limits of the target he will also sense the shot as "over" or "short." The battery commander will then proceed to adjust the center of impact on the target. In order that he may properly conduct the adjustment fire the battery commander makes use of certain factors which depend upon the location of the guns, observation post, and the target.

To determine these factors the following must be known for each target: (a) The angle OTG; (b) The distance OT; (c) The distance GT. There are two factors used in Unilateral Observation Case I, the "R" factor and the "F" factor. The "R" factor is the factor used at the guns by which observed deviations at the OP must be multiplied in order to throw the burst on the OT line. The "F" factor, used in sliding, determines the amount of change in deflection that must be made at the guns, when a change of one fork in elevation is made, in order to keep the burst on the OT line.

Unilateral Observation Case II is used when the angle OTG is larger than 300 mils. In this case there are three factors to consider, these factors depending upon the same conditions as in Case I. The "R" factor is again used to determine definite right or left deflections. The "M" factor is used to throw the burst on the OT line. The "S" factor is used in sliding, being the factor by which range change per mil change in deflection is determined.

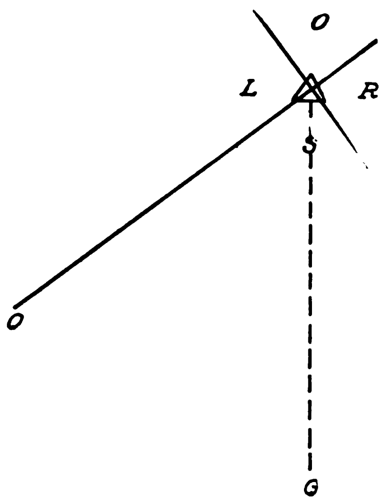


FIG. 2

In explaining the Spiral method of Unilateral Observation reference is made to Fig. 2. The observer places the intersection of the cross wires of the observing instrument on the target. The terrain in the vicinity of the target is divided into four quadrants as shown marked O, R, S, and L. The observer knows that he is on the left of the GT line. He knows that any shot falling in quadrant O is surely "over" from the battery and he so reports. Similarly shots falling in quadrants R, S, and L would be, respectively, "right," "short," and "left." When a shot falls on or near the dividing line of two quadrants, for example on the line between O and R, information of double value is obtained. It would be sensed as "over" and "right."

Consider now the Battery Commander. He knows whether he is on the right or the left of the GT line and that is all the data he needs to conduct the adjustment. He does not have to compute any factors or remember any complicated rules of adjustment. He is furnished by the observer with definate information as to the fall of shots with reference to the GT line. With this information he may apply simple rules for adjustment, similar to the bracketing

method used with axial observation, and in a comparatively small number of rounds will secure an adjustment.

The following rules for adjustment may be used with this method of observation:

TRIAL FIRE. (a) Fire first shot with computed, measured, or estimated data depending on time available for computation.

(b) Change elevation, or deflection, or both, by one "preliminary bracket" when an observation is obtained. The size of the "preliminary bracket" should be determined by the dependability of the initial firing data. The "preliminary bracket" should be large enough so that one change of data will give a sense in the opposite direction. In case too small an initial change has been selected more than one application of the "preliminary bracket" will be necessary before an opposite sense is secured.

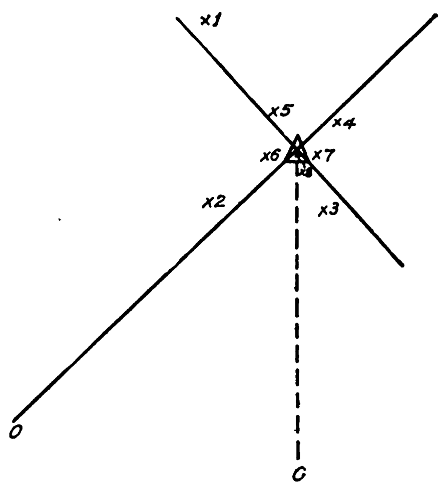


FIG. 3

(c) When an opposite sense has been secured "split" between elevation and deflection limits until a "hit," "contradiction" or "a verified bracket of one range table fork" is secured. A "hit" or "contradiction" is justification for beginning improvement fire with the elevation and deflection at which these results were obtained. If a verified bracket of one range table fork is obtained the mean of the bracketing data is the trial data.

IMPROVEMENT FIRE. (a) Using trial data fire a series of six or eight shots. If in any series an equal number of overs and shorts and rights and lefts does not occur, apply the "over-short" rule and the resulting data will be the adjusted data.

FIRE FOR EFFECT. (a) Fire for effect will follow improvement fire without interruption beginning with the adjusted data and the center of impact will be kept near the target with an equality of overs and shorts by the method prescribed for improvement fire.

In order to illustrate the application of this method a typical example is shown in Fig. 3. Noting the points of impact of successive shots, as the rules for adjustment are applied, the reason for the name "spiral" will be apparent.

Assume the first burst to be at X *1*. The observer's report will be "over," and a correction by the battery commander of down "one preliminary bracket" in elevation will cause the second burst to appear at X *2*, "left." A change of one "preliminary bracket" in deflection will throw the next burst at X *3*, "short." Split the elevations at which the first and third shots were fired and the fourth shot is shown at X *4*, "right." Following the rules for adjustment split the deflections used for the second and fourth shots and the fifth burst will be at X *5*, "over."

Split again between the closest elevation limits, shots 3 and 5, and the sixth burst will be at X *6*, "left." Splitting between closest deflection limits, shots 4 and 6, the seventh shot will fall at X *7*. Again splitting deflection between shots 6 and 7 will secure a burst at X *8*, a "hit." Of course such exact response to corrections will not always take place in actual firing but in most problems will approximate these very closely.

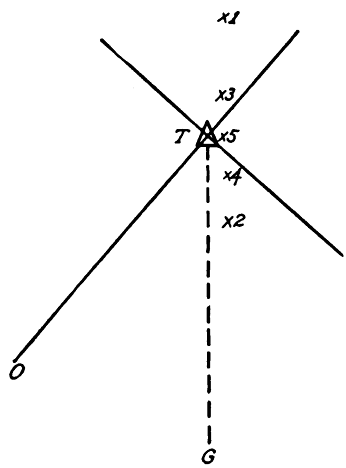


FIG. 4

Another case which will often arise is when you may start firing with the approximately correct deflection, but be considerably off in range. This situation is illustrated in Fig. 4. Assume the first burst at X *1*. The second shot fired with an elevation which has been decreased by one "preliminary bracket" will strike at X *2*. Splitting elevations will throw the impact of shot No. 3 at X *3*. Continuing to narrow the elevation bracket in the same manner will throw the next two bursts at X *4* and X *5*. X *5* will be reported as "right," this being the first information the Battery Commander has received as regards deflection. The point that it is desired to emphasize is that it would now be an improper procedure for the Battery Commander to apply a deflection change of a "preliminary bracket" in deflection. Such a change would throw the next shot entirely off the target in deflection and several shots would have to be fired before the center of impact would be back as close to the target as it is now. The fact that five shots were fired before a deflection observation was obtained, two "over" and two "short" and one "right" is a sure indication that the deflection is very nearly correct otherwise shots 3 and 4 would probably have been "right." At this stage the Battery Commander should confine his deflection changes to a range table deflection fork in proceeding with his adjustment.

A similar case to this will arise when the problem is started with an approximately correct range, the bursts in this case moving from side to side across the target. (Fig. 5).

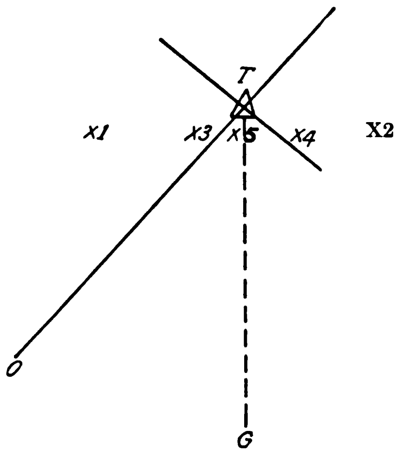


FIG. 5

Another case often arises when double information may be obtained from the fall of a shot. Referring to Fig. 6 assume the first shot to fall at X *1*, "over." Decreasing the elevation by one "preliminary bracket" throws the next burst at X *2*. This being on the dividing line between two quadrants will be sensed, "right"

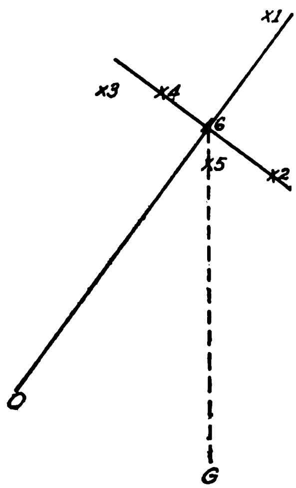


FIG. 6

and "short." A correction left one "preliminary bracket" should be made and the elevation split between elevations used for shots 1 and 2. Firing with this data assume the next burst at X *3*, "left." Splitting between shots 2 and 3 for a deflection correction will cause the next shot to fall at X *4*, on or near the dividing line of two quadrants. Here again is information of double value, this burst being sensed as "left" and "over." Now split between the elevations and de-

flections used for shots 2 and 4 and the next shot will fall at X 5, "short." Splitting the elevations at which shots 4 and 5 were fired will throw the next burst at or near the target.

The spiral method has been successfully used in the 92d Coast Artillery (PS) when training officers in fire adjustment.

The following advantages of this method are claimed in comparison with Case I and Case II unilateral observation:

(a) No orientation of OP required.
(b) No computation factors necessary.
(c) Good for any angle of observation.
(d) Application of simple rules of adjustment.
(e) Observer not limited to any one position or to any particular target.
(f) Adjustment more quickly secured with a consequent saving of time and ammunition.

This paper is submitted for publication with the hope that it will attract the attention of artillery officers and if found worthy of merit that the method may be adopted as one of the standard methods of fire adjustment with unilateral observation.

A Method of Eliminating Errors in the Elevating Mechanism of Antiaircraft Guns

By Lieut. J. E. Reierson, C. A. C.

There are such large variable errors in the elevating mechanism in the 3-inch A. A. guns that it was necessary to devise some method to correct for the same if we were to get satisfactory results.

A mean arbitrary correction was used at first but this was unsatisfactory for the errors varied as much as 20 mils from the mean on some; thus giving differences of 40 mils in the angular heights of bursts at some parts of the course.

The following method which practically eliminates all errors in elevation due to backlash, lost motion and faulty parts has been used by both batteries of the 62d Coast Artillery, for all record and test practices in the Joint Exercises of the Coast Artillery and Air Service now being held at Fort Tilden, N. Y., and given practically no errors in elevation. It is based on the following facts.

1. That when firing at a moving target the angle of site increases and the fuze range decreases when the gun is elevated, and the angle of site decreases and the fuze range increases when the gun is depressed.
2. That the quadrant elevation error in the elevating mechanism will be practically the same whenever the gun is given the elevation, the angle of site and the fuze range with which it was determined (under conditions Par. 1).
3. The errors in the elevating mechanism are not materially different for quadrant elevations differing by 50 mils (depending on the gun) for the same angle of site and fuze range; for example:

i	*s*	*B*	*Error*	*Arbitrary Correction*
450	346	14	+ 70 mils	— 70 mils
500	396	14	+ 69 mils	— 69 mils
550	446	14	+ 65 mils	— 65 mils

therefore i = 500 can be used in determining the errors for quadrant elevations 450 — 550 and i = 600 for 550 — 650, etc. (the elevations and angles of site both gotten by elevating to their readings while the fuzes were gotten by depressing the disc).

4. That it is possible to obtain the quadrant elevation of the gun at any time by putting a fixed index on the trunnion cap and a mil scale on the trunnion; this can be read by the vertical deflection setter.

The following is done in sequence:

The gun is boresighted as follows: the regulation target is used and the gun is given an elevation of 178 mils and the target so placed that the axis of the bore passes through its center; the sight is now *elevated to* its target and the reading recorded. This process should be done three times and the mean of the three recorded; this to be known as the Elevated Bore Sight (E. B. S.). The reverse should now be done three times, that is, depress the sight and the mean recorded, this to be known as the Depressed Bore Sight (D. B. S.). This gives the error in the sight when the sight is elevated, that is (178 — E. B. S.) and the error when the sight is depressed (178 — D. B. S.).

The gun is given a quadrant elevation of say 500 mils and by entering the Table of Fuze Settings all angles of site and the fuze ranges for that trajectory can be obtained and the errors in the elevating mechanism for each burst determined as follows:

The elevation being set, the gun pointer sets the angle of site (corrected) on his sight and the Fuze Range Setter sets the fuze for that burst and No. 1 brings the pointers together by means of the Arbitrary Correction Knob* and the reading (correction) recorded. The same is done for every trajectory differing by 100 mils (or less depending on the gun) and corrections for each determined being careful that when the gun is *elevated to* its reading that the sight is *elevated to* its angle of site and the Fuze Range Disc is rotated by *decreasing ranges to* its Fuze Range and vice-versa when depressing. The gun having been *elevated to* (or *depressed to*) 500 mils, it remains undisturbed for all bursts on that trajectory.

The corrections for a 3-in. A. A. gun for a 500 mil trajectory are as follows:

ARBITRARY CORRECTIONS FOR DECREASING FUZES

Gun No.	*i*	*(E)B.S.*	*(E)B.S. Corr.*	*Angle of Site*	*Corr. Site*	*B**	*ACDB*	*ACDB*	*ACDB*	*AV ACDB*
I	500	154	-23	370	347	16	—97	—101	—100	—97
				377	355	15.5	—95	—101	—100	—97
				383	360	15	—100	—101	—99	—100
				390	367	14.5	—100	—101	—99	—100
				896	873	14	—100	—101	—100	—100
				402	379	13.5	—100	—97	—100	—99
				408	385	13	—99	—96	—94	—96
				414	391	12.5	—97	—95	—98	—97
				419	396	12	—97	—96	—98	—97
				424	401	11.5	—90	—91	—91	—91
				429	405	11	—91	—88	—92	—90
				434	411	10.5	—89	—85	—92	—89
				438	415	10	—91	—90	—86	—88
				443	420	9.5	—91	—86	—86	—88
				448	425	9	—89	—85	—86	—87
				452	429	8.5	—88	—85	—86	—87
				456	433	8	—86	—86	—85	—85

*Only those fuzes likely to be used.
i—Elevation.
(E) B. S.—(Elevated) Bore Sight.
B—Fuze.
ACDB—Arbitrary Correction Decreasing Fuze.

*With some guns where there is backlash in the gear of the arbitrary correction scale it will be necessary to get the elevation pointers to always approach coincidence. In the same way; likewise to set corrections on the scale. The same may be necessary in setting vertical deflections.

ARBITRARY CORRECTIONS FOR INCREASING FUZES

Gun No.	i	(D)B.S.	(D)B.S. Corr.	Angle of Site	Corr. Site	B*	ACIB	ACIB	ACIB	AV ACIB
1	500	—133	—45	456	411	8	—71	—69	—71	—70
			—45	452	401	8.5	—71	—72	—72	—72
			—45	448	403	9	—74	—76	—74	—74
			—45	443	398	9.5	—74	—73	—73	—75
			—45	438	393	10	—75	—71	—74	—74
			—45	434	388	10.5	—75	—72	—74	—74
			—45	429	384	11	—77	—77	—76	—77
			—45	424	388	11.5	—79	—79	—78	—79
			—45	419	374	12	—79	—79	—83	—80
			—45	414	368	12.5	—79	—79	—82	—80
			—45	408	363	13	—84	—83	—88	—85
			—45	402	357	13.5	—88	—89	—89	—89
			—45	396	351	14	—88	—85	—84	—87
			—45	390	344	14.5	—84	—85	—89	—87
			—45	383	338	15	—88	—85	—92	—85
			—45	377	332	15.5	—92	—83	—90	—89
			—45	370	325	16	—97	—94	—93	—95

*Only those fuzes likely to be used.
i—Elevation.
(D) B. S.—(Depressed) Bore Sight.
B—Fuze.
ACIB—Arbitrary Correction Increasing Fuze.
Corr.—Correction.

The arbitrary corrections for each trajectory (differing by 100) can be tabulated in a column on the Fuze Range Disc so that each correction is tabulated on the proper curve. The columns of ACDF to be on the left of the Fuze Range Disc figures and the columns of ACIF to be on the right. Red ink can be used for the minus corrections and black for plus; as that is the color of the figures on the knob. The fuze Range Setter sets the corrections shown on the curve which pointer is on, the correction being determined by the quadrant elevation and the increasing or decreasing fuzes.

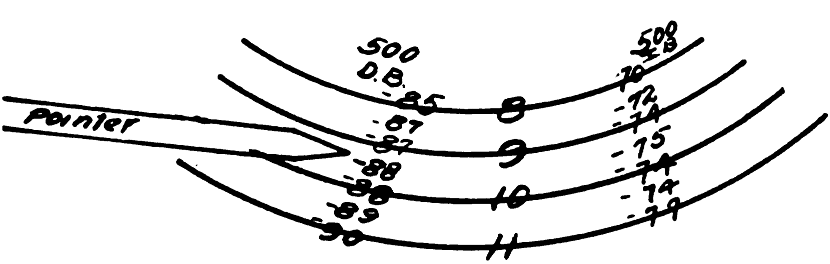


FIG. 1

For example if his Fuze Range Pointer was on 9.5 and the fuzes were decreasing he would set —88 on his arbitrary correction knob, or these columns could be put on a chart (as below) if the lines of flight were not known, or for war conditions when all elevations might be used; and another man be added to the section to give the corrections to the fuze range setter.

Increasing Fuzes			Decreasing Fuzes		
i	*B*	*A.C.*	*i*	*B*	*A.C.*
200	2	— 20	200	2	+ 23
	2.5	— 18		2.5	+ 23
	3	— 18		3	+ 28
	3.5	— 16		3.5	+ 34
	4	— 20		4	+ 36
	4.5	— 23		4.5	+ 43
	5	— 27		5	+ 50
	5.5	— 20		5.5	+ 50

The correctness of this method is proved by setting the corrected angle of site, fuze, and arbitrary correction for any burst and elevating (or depressing, if the arbitrary correction was obtained for increasing fuzes) the gun until the pointers are together. The elevation is now taken with the quadrant and should give the elevation of the trajectory which this burst is in. For example; the ACBD for i = 500, B = 10, S = 438, Corr. angle site = 415, is — 88 mils, therefore to prove the correctness of —88 we depress the gun below 500 mils; set 10 on the fuze range disc (by depressing to 10); set the arbitrary —88 on the arbitrary correction knob; set the corrected angle of site 415 on the sight by *elevating* the sight *to* 415. The gun is now elevated until the pointers are together. The elevation is now checked by quadrant and should be 500 mils. This method of proof is used to find when it is necessary to obtain new arbitrary corrections. It will usually be necessary to determine new arbitrary corrections whenever any adjustments or replacements of parts have been made in the elevating mechanism. This requires less than an hour per gun.

It is the opinion of the writer that this method will put a large amount of unserviceable (due to errors in the elevating mechanism) materiel into service.

The 8-Inch Railway Gun

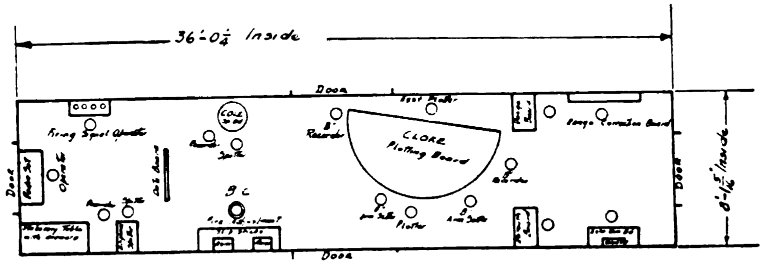
By Captain E. M. Benitez, C. A. C.

There is one type of artillery that has not received as much publicity as it deserves, and it is my purpose in writing this article to acquaint the officers of the Corps with the latest developments and results obtained with the Railway Artillery that we now have, with particular reference to the 8-inch gun.

Our present Railway Artillery regiments are equipped with 12-inch mortars and 8-inch guns on railway mounts attaining ranges of 15,000 and 23,000 yards respectively, and are the only all-around-fire guns available for training at present as new types are not ready for issue. Without any doubt, at the outbreak of a war, these two types of weapons will be called upon to play an important part and will be the first to go into service due to the large number available at the present time. Furthermore, training on these guns will enable the battery organization to handle any of the new types of railway mounts that are being developed.

While the relative accuracy of the 12-inch mortar has not been questioned, yet there are a large number of officers who believe that the 8-inch railway gun is very erratic and are skeptical about its use and value in actual warfare. It is, therefore, important that this erroneous belief be cast aside and facts be presented so that a clear conception of the accuracy and usefulness of this type of armament may be established.

Fire Control System.—The fire control system at present used in the 52d Coast Artillery has been designed and perfected by different officers on duty with that regiment since 1922, and has been designed so that it is applicable without modifications, except as to minor details, to railway guns in general and for use at fixed or moving targets. It is also capable of furnishing when necessary, firing data to each gun of a *four-gun* battery, firing one four-gun salvo per minute, and permits the application of group and individual corrections for each separate gun for both range and direction. A typical interior arrangement of a fire control car is shown herewith.



INTERIOR ARRANGEMENT OF FIRE CONTROL CAR
Battery 'F' 52d C A
June 11, 1924

Fig. 1

General Information on the 8-inch Railway Gun.—The diameter of the bore between lands is eight inches and the total length of the gun is 35-calibers with a weight of 32,000 pounds. It has 360 degrees traverse with a firing angle of from 0 to 42 degrees, giving a maximum range of 23,000 yards, when firing a 323 lb. projectile with a muzzle velocity of 2250 feet per second. It has one cast steel recoil cylinder, 9.25 inches inside diameter by 54 inches in length, the recoil mechanism operating on the principle of the hydraulic brake, and is designed to limit the distance and regulate the velocity with which the gun moves to the rear when the piece is fired. The greater portion of the energy of recoil is taken up by the resistance of the oil in the recoil cylinder to being forced through the orifices formed by the throttling grooves. The length of recoil is 48 inches. The counter recoil mechanism consists of four cylinders secured to the cradle by forged steel bands, each cylinder containing a set of three coil springs. As the gun recoils when the piece is fired, it carries with it the spring rod and piston thus causing the springs to be compressed. With the gun in full recoil position there is sufficient energy stored in the springs to bring the gun back to battery.

The amount is of the outrigger type, eight outriggers being furnished with each car, which form braces to prevent the car from tipping over or from sliding on the ground when the gun is fired.

Battery Organization.—The composition of an 8-inch gun battery is four guns, five officers and 177 enlisted men (See Table of Organization 500 W). The assignment of officers is as follows: Battery Commander, Battery Executive, Assistant Executive, Range Officer and Railway Officer. The battery is composed of Battery Headquarters, Firing Sections and Maintenance Sections, with their corresponding duties to perform.

Results and Comments.—One of the main arguments used against railway artillery is lack of accuracy, but if we are to judge the results obtained by the

8-inch railway gun in target practices, then this argument can be readily disproven, notwithstanding the fact that these mounts were hurriedly designed when guns were badly needed at the front and consequently do not approach the ideal. If after examining the results which will be herein presented, it is considered that these target practices mentioned have been fired with a "home-made" fire control system, with boards constructed locally admitting errors due to shrinkage of wood and defects in workmanship, then it can be readily seen that this 8-inch fires just as well and as accurately as any fixed defense gun of equal caliber.

In December, 1922, the fire control system at present used by the 52d Coast Artillery was first used and two target practices were fired at an average range of 12,700 yards. Four-gun salvos per minute were successfully fired and the probable error developed by this gun was 75 yards.

During two target prcatices conducted by Battery F, 52d Coast Artillery in May, 1923, in which a total of 107 shots were fired, the probable error developed by this gun at mean ranges of 13,476 and 13,630 yards was 62 yards and 70 yards respectively. Firing indirect fire in the last of these two practices, in which the "slip-stick" method of fire adjustment was employed and in which a total of 57 shots were fired, the percentage of shots falling within 50 yards of the target was 33, while 51 percent of the shots fired fell within one and one-half times the Range Table probable error which is 72 yards. The greatest range deviation was 241 yards, all shots falling within the ladder of dispersion, and the 57 shots of the practice were fired in 39 minutes, twenty-two two-gun salvos being fired with only one relay, which was almost unavoidable. Can such a gun be classified as erratic? What major caliber fixed defense battery (not calibrated), can produce better results for such a long sustained rate of fire?

Excellent results were also obtained at the annual target practice of this same battery on June 11, 1924, at which the probable error developed at a range of 14,000 yards was 67 yards.

On July 12, 1924, this same battery fired a problem under the direction of the Reserve Officers of the 603d Coast Artillery (Railway), and better results than those obtained can hardly be expected. The last three salvos fired for effect fell as follows: short 30, over 12; short 33, short 3; over 18, over 39, giving center of impact of short 9; short 18; over 24 yards respectively.

Thus we see that these gratifying results obtained by the 8-inch railway gun have not been obtained through mere luck or chance, and have been consistently obtained in practically all target practices that I have witnessed since 1922.

I could not close this article without saying a word in favor of railway artillery, which has now passed its trial stages and which in the successful accomplishment of the mission of Coast Artillery is destined to play a leading part.

A close study of the official railroad map published by Rand McNally Co., will convince anyone that this is an ideal country for the use of railway artillery, where the tracks have been laid and the bridges designed to stand heavy loads, and even without further construction there is practically no part of the coast or border lines, that cannot be readily and easily defended by this formidable weapon.

It must be admitted that the Navy is in a better position to judge what type of shore batteries render more effective results in guarding the coast, thus giving the Navy a freedom of strategic movement. If we study the most recent papers on naval strategy and tactics, we will see that experienced officers of our own navy believe that railway artillery presents to an attacking fleet a more complicated and difficult problem than fixed seacoast fortifications. Large caliber railway guns moving about in defense of a coastal area would be very puz-

zling to an admiral charged with landing an army on a hostile coast, much more puzzling than if the same number of guns were in a fixed position where their range is known and cannot be extended. However, if they are able to shift their position along the coast, the area they defend is no longer a semicircular one, but is a broad coastal band that is very forbidding to hostile fleets and transports.

Better Antiaircraft Guns

[Reprinted from the *New York Times*]

The practice firing of antiaircraft guns at targets towed by airplanes near Fortress Monroe, March 6, was so poor that it was generally believed General William Mitchell had proved his case. It was his contention that bombing planes were in no serious danger from guns mounted on ships or in fixed positions on shore. At the front in France planes seldom succumbed to gunfire, although shot at constantly. A service periodical, the COAST ARTILLERY JOURNAL, took issue with General Mitchell in its March number. Admitting that a few years ago the Army and the Navy had no antiaircraft guns to afford protection to military and industrial areas, it said:

> Today, thanks to the enormous strides that have been made in the development of our antiaircraft guns, conditions are vastly different. Even with the equipment we now have, America's antiaircraft troops would make it a most hazardous undertaking for an enemy flier to soar over any area defended by them. These troops are not at present equipped with the last types of antiaircraft cannon and machine guns. When they are so equipped, no enemy bombing plane will be able to fly at a sufficiently high altitude to avoid the probability of being quickly shot down by them, nor will any enemy fighting plane be able to attack at low altitudes without being met with a withering fire from our newly developed, high-powered machine guns with their rate of fire of 450 rounds per minute.

This service paper seems to be right, judging from the results of recent practice firing at Fort Tilden, New York, Fort Barrancas, Fla., and San Francisco. At Fort Tilden the target used was a cloth bag about nineteen feet long and five feet in diameter, tapering down to three and a half feet. Its surface was about one-fourth that of a bombing airplane. At the end of a wire, 2100 feet long this target was towed by a plane at an elevation of 6000 feet. The Fort Tilden gunners scored twenty-five hits in eight minutes and forty seconds of firing while the target moved at a speed of seventy miles an hour. Altogether 445 shots were fired. According to an advance statement given out at Washington, the percentage of hits was 5.6.

The guns used at Fort Tilden were three-inch. Another report from the New York practice is that sixteen machine guns, firing 15,574 rounds in five minutes, scored thirty-nine hits against low-flying plane targets 3000 feet distant. A "hit" was a technical term as used by two observers of the practice. One was in the plane towing the target and another was on the ground. If a shell burst fifty yards from the flying target, a "hit" was recorded. The reason, given by General Hines, Chief of Staff, is that high explosive shells have a wide range of destructiveness. Single shots are of course not fired at enemy airplanes. The formula adopted for target practice in this case is fair. At San Francisco and at Fort Barrancas, Fla., the firing was not done on such an extensive scale, but a good percentage of hits was scored. In the practice at Fort Tilden one target was shot down and seven holes were counted in other targets.

The showing made by the coast artillerists will doubtless be challanged by aviators. They will not be inclined to acknowledge "bursts" as hits, and they

will point to the fact that the latest bombing airplanes move at a much greater speed than seventy miles an hour. They will argue that the element of surprise does not exist in peace target practice. And they will declare that such practice is always much better in "results" than the scores made in the excitement and nervous tension of battle. The obvious rejoinder is that, just as the COAST ARTILLERY JOURNAL has held, "enormous strides" have been made in improving anti-aircraft guns. They can now comb the sky as never before. As to the experiments at Fortress Monroe on March 6, it is only fair to the gunners to say that the weapons used were not of the latest type and that they had to contend with a very high wind.

Fort Worden, Washington

By FIRST. LIEUT. EDWARD L. SUPPLE, *C. A. C.*

The history of Fort Worden, Washington, is rooted deeply in the contest for the possession of the western coast of North America. From the voyage of discovery of Cortez in 1521 and Drake in 1579 dates the struggle between Great Britain and Spain for the possession of our western shore. This struggle, spurred on by the Russian explorations and the raise of the Russian fur trade in 1740, was finally concluded by the Nootka Treaty in 1790, in which Spain relinquished title to the region north of the Oregon country and gave to England ocean to ocean possession of what is now the Dominion of Canada.

The purchase of Louisiana in 1803 was the first step of the new born nation freed from the yoke of a tyrannic government, in its territorial expansion. The exploration trip of Lewis and Clark, 1803-07, whose purpose was to find a portage from the headwaters of the Missouri to the Pacific Ocean, opened up a vast territory in the Oregon country, in their finding of this portage from the Missouri to the Snake River. The way shown, brought later a great influx of settlers to the new country, who engaged in fur trading, from which grew an intense rivalry with their British competitors, the Hudson's Bay Company and the Northwest Fur Company. This, from a rivalry of commerce, became a contest between the two nations for the possession of the new territory which was finally settled in 1846 by the Treaty of Limits. The provisions of the Treaty of Limits continued the northern boundary of the United States along the 49th parallel, westward to its junction with the channel passing south of and separating Vancouver Island from the mainland.

The year 1846 also brought out the consideration of the task of fortifying the western coast of the United States. A joint board of Army and Navy officers studied the coast line and made recommendations for the location of the several fortifications that now exist. A more detailed study and plan was recommended by General J. G. Totten in 1860, which, while action was postponed by the Civil War, resulted in President Johnson, in 1866, setting aside large tracts of land along the Pacific Coast as military reservations. Among these was a tract of 640 acres set aside for the site of Fort Worden. The original tract has been added to from time to time as the need has been shown.

The completion of the transcontinental railroad with its terminal at Seattle, Washington, in 1885, and the construction of Puget Sound Navy Yard in 1891, gave rise to a more complete plan for the protection of Puget Sound.

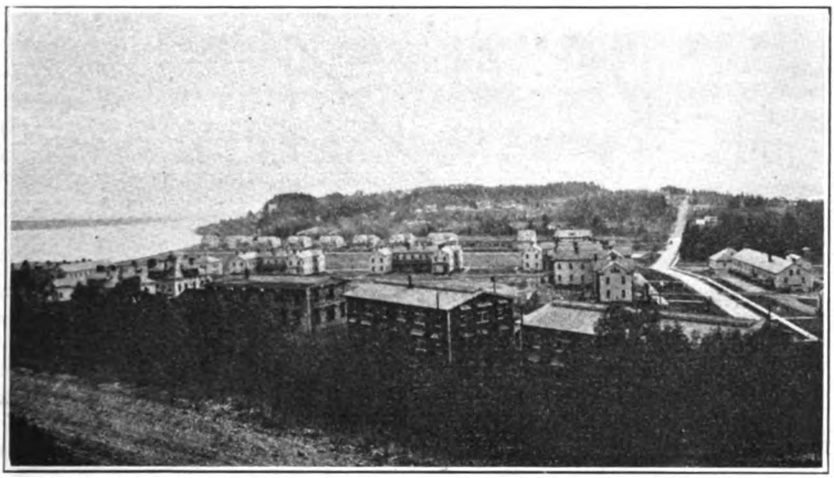
The first batteries constructed were batteries Randol, Quarles and Brannan, commenced in 1898 and completed in 1900. The first two were ten-inch rifles with barbette carriages and the third was a battery of twelve-inch mortars.

The post armament was further strengthened upon the recommendation of a board by Secretary of War Taft, the most modern armament being added to the fortification already installed.

A complete antiaircraft battery has since been installed, making Fort Worden the most formidable and modern on the Pacific Coast. The present scheme of searchlights was commenced in 1910 and completed in 1911.

Fort Worden during the World War contributed largely to the American Expeditionary Forces, seven regiments of Artillery being organized wholly or in part in the Coast Defenses. Those of the seven that saw action earned an enviable reputation for themselves.

Since the war, Fort Worden, in addition to being charged with the keeping of an adequate defense, has also been given the task of the annual training of the Oregon and Washington National Guard and the Organized Reserves in the State of Washington.



Although the authorized quota of men allotted to the Coast Defenses has been reduced, the training at the several forts is still being carried on with the same high standard of excellence. At the present time preparations are being made for the annual target practice, which holds the attention of everyone.

The Educational and Vocational Training Schools are being carried on by trained corps of instructors. All academic subjects are covered in the educational branch, which, with the Vocational Training School, holds sessions on five afternoons per week. The Vocational School provides courses in Machine Shop Practice, Welding, Forging and all phases of Automobile and Motor Cycle Construction and Repair. These vocational courses have for their laboratories a most complete and modern machine shop capable of turning out any of the largest and most refined pieces of work in automotive construction.

A Service Club, which has been remodeled and enlarged several times since the days of '17, contains a first-class library and assembly room. In the post theatre, housed in the same building, the latest screen productions are shown four times per week.

A brief history of the companies that belong at Fort Worden would complete the story, but it suffices to say that their records date back as far as the days of the Revolution, when the first permanent artillery troops were organized, and their reputations have been sustained through every war since that time.

Approximate Determination of the Height of Burst

By ENRICO BIANCO DI S. SECONDO

Translated from the *Rivista Marittima* by Colonel Frank E. Harris, C. A. C.

On the proving ground as in antiaircraft batteries it may sometimes be desirable to know the approximate height of burst of an antiaircraft projectile when the only data available is the measured angle of site.

The method here given is based on two measurements:

1. The angle of site ϵ, of the smoke ball;
2. The time interval between the burst and its auditory perception.

It will be seen below that the results obtained are more than satisfactory.

Let O be the observer, S the point of burst, ϵ the angle of site of the smoke ball and X the distance measured along the line of site; we will then have:

$$Y = X_\epsilon \sin \epsilon.$$

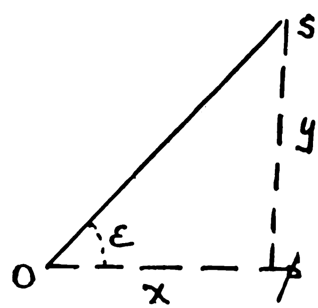


FIG. 1

If W is the velocity of sound and τ the time between the burst and its auditory perception, we have:

$$X_\epsilon = W\tau$$

whence

$$Y = W\tau \sin \epsilon. \qquad (1)$$

With reference to the factor W, we know that its value depends chiefly on the temperature and is influenced by the humidity and wind. The humidity influence, however, is negligible (Charbonnier.—Balistique exterieure) and the wind effect will be discussed further on, so that we may say:

$$W = W_0 \sqrt{1 + \alpha\,\Theta}$$

in which:

Θ = air temperature on the centigrade scale

$\alpha = \dfrac{1}{273}$ and

W_0 = (velocity for Θ = O) = 330.9.

This formula was used to calculate Table I for values of Θ from $-30°$ to $+30°$.

If, therefore, the temperature of the air stratum to the point of burst were constant and equal to that at the ground the problem would be solved.

But, as is known, the temperature diminishes as the altitude increases.

Hence the problem will have to be solved in two stages. In the first stage the temperature will be assumed constant and thus a first approximate value of Y obtained:

$$Yap = W_{\Theta}\ \tau \sin \epsilon$$

in which W_{Θ} corresponds to the temperature at the ground and is taken from Table I.

Having obtained this approximate value we next apply the temperature formula for the altitude Y:

$$\Theta_y = \Theta_0 - \frac{y}{100} \Delta \Theta \%$$

in which

Y is the altitude.

$\Delta \Theta \%$ the thermal gradient ($\Delta \Theta$ for $\Delta y = 100$ meters), and

Θ_0 the temperature at the ground.

Hence the mean temperature between the ground and the height Y will be:

$$\Theta_m = \tfrac{1}{2} (\Theta_0 + \Theta_0 - \Delta \Theta \% \frac{y}{100}) = \Theta_0 - \Delta \Theta \% \frac{y}{200} \qquad (2)$$

The value of $\Delta \Theta \%$ varies according to the stratum of air considered and the season.

Prof. Gamba's experiments have provided the data for computing Table II, which gives the value of $\Delta \Theta \%$ as a function of the season and the approximate height of burst and serves for the computation of the value of Θ_m (Θ corresponding to $\frac{Yap)}{2}$.

With this value we obtain from Table I the value:

$$W\ \Theta_m$$

whence we finally have:

$$Y = W\ \Theta_m\ \tau \sin \epsilon.$$

From trials made it has been found unnecessary to make a second computation to obtain a closer approximation. (The correction after a third approximation in the least favorable cases would be about one-thirtieth of a meter).

Differentiating the formula:

$$Y = W\ \tau \sin \epsilon$$

and substituting the finite differences for the corresponding differentials, we have

$$\Delta Y = W \sin \epsilon\ \Delta \tau + \tau \sin \epsilon\ \Delta W + W\ \tau \cos \epsilon\ \Delta \epsilon$$

We see at once that the first and second terms are maximums for $\epsilon = 90°$ and minimums for $\epsilon = 0°$, and that the third term is a maximum for $\epsilon = 0°$ and a minimum for $\epsilon = 90°$, and hence the maximum value of ΔY will be less than the sum of the maximum.

Let us examine the three terms in succession:

1st term: error in τ

We have: $E\tau = W \sin \epsilon\ \Delta \tau$

which as a maximum value for $\epsilon = 90°$ and W corresponding to $\Theta = 30°$ (an exaggerated value since Θ is the mean temperature and certainly much lower) gives us

$$E_{\tau(max)} = 348.6\ \Delta \tau$$

Based on experiments made by a careful observer and good chronograph, we may take as a maximum value for $\Delta \tau$ the value of 0.25, and hence:

$$E \max = 87.$$

2nd term: error in W.

We have:

$$E_W = \tau \sin \epsilon \, \Delta W.$$

and for $\tau = 40$ seconds (corresponding) to X_ϵ of more than 12000 meters, a value that is certainly not attained) and $\epsilon = 90°$ gives us

$$E_{W\max} = 40 \, \Delta W.$$

What error can be committed in W?

(1) We have neglected the influence of the humidity: but (Charbonnier—Balistique) the correction of W is but a few tenths of a meter: it is therefore absolutely negligible.

(2) The wind for firings at high altitude and large angles of site, which is the case presented in this study, is nearly normal to the line, point of burst—observer, and, moreover, in proving ground firing, must have a limited value and hence its influence is negligible.

(3) The temperature at the ground is measured with all the accuracy that may be desired and cannot give rise to errors.

(4) The value of $\Delta \, \Theta \, \%$ is also quite accurate, due to the accuracy and number of the experiments from which deduced: and it is to be noted there can be no irregular variation under the conditions the firings are executed on the proving ground (fine weather).

Hence it certainly is not an excessive exaggeration to assume 3 m as a maximum value for Δ W, and hence:

$$E_w \max = 120$$

3rd term: error in ϵ

We have

$$E_\epsilon = W \, \tau \cos \epsilon \, \Delta \epsilon$$

This error may be quite large owing to the difficulty of observation, particularly for a shot bursting at a distance from the predicted point and on which the telescope is directed, but assuming

$$\Delta \epsilon = 2°$$

we are certainly within rather wide limits.

And therefore, assuming for W the value 348.6, for τ, 40 seconds, and for ϵ, 0°, or, adopting the very worst conditions, we have:

$$E_\epsilon \max = 348.6 \times 40 \times .034 \quad 474.$$

whence

$$\Delta Y \max = 87 \sin \epsilon + 120 \sin \epsilon + 474 \cos \epsilon = 207 \sin \epsilon = 474 \cos \epsilon.$$

And therefore the maximum value of Δ Y corresponds to a value of $\tan \epsilon = \frac{207}{474}$,

whence

$$\epsilon = 23° \, 36' \text{ nearly.}$$

Substituting this value in the expression for Δ Y max, we obtain:

$$\Delta Y \max = 207 (\sin 23° \, 36' + 474 \cos 23° \, 36') = 83 + 434 = 517.$$

This value, however, is a maximum which is never attained.

If for example (taking data corresponding to a practical case) we have:

$$\tau = 30°, \epsilon = 75°, \Theta_m = 5°.$$

and we assume the commission of maximum errors of the elements τ, W, and ϵ, we have:

$$\Delta Y = 333.9 \times 0.96593 \times 0.25 + 30 \times 0.96593 + 3 +$$
$$100170 \times 0.25884 \times 0.034 = 81 + 87 + 89 = 247.$$

We note that we also have the abscissa of the point of burst;

$$X = X_{\epsilon} \cos \epsilon$$

and by also measuring the azimuth with respect to the plane of fire, we obtain the drift.

We would thus have the three coordinates (x y z) of the point of burst, and the time of burning the fuse and hence, lacking other means, we might also deduce the data for a range table. But evidently the method does not give the desired accuracy though it might, for example, be regarded as sufficient on the occasion of fuse testing.

TABLE No. I

Table of values of W for different values of

Θ	0	1	2	3	4	5	6	7	8	9
0	330.9	331.5	332.1	332.7	333.3	333.9	334.5	335.1	335.7	336.3
10	336.9	337.5	338.1	338.7	339.3	339.6	340.5	341.1	341.7	342.3
20	342.8	343.9	344.0	344.6	345.2	345.8	346.3	346.3	347.5	348.0
30	348.6									
Θ	**0**	**−1**	**−2**	**−3**	**−4**	**−5**	**−6**	**−7**	**−8**	**−9**
0	330.9	330.3	329.7	329.1	328.5	327.9	327.8	326.6	326.0	325.4
−10	324.8	324.1	323.6	322.9	322.3	321.7	321.1	320.4	319.8	319.2
−20	318.6	317.9	317.3	316.7	316.0	315.4	314.8	314.1	313.5	312.8
−30	312.2									

TABLE No. II

Values of $\Delta\Theta$ %

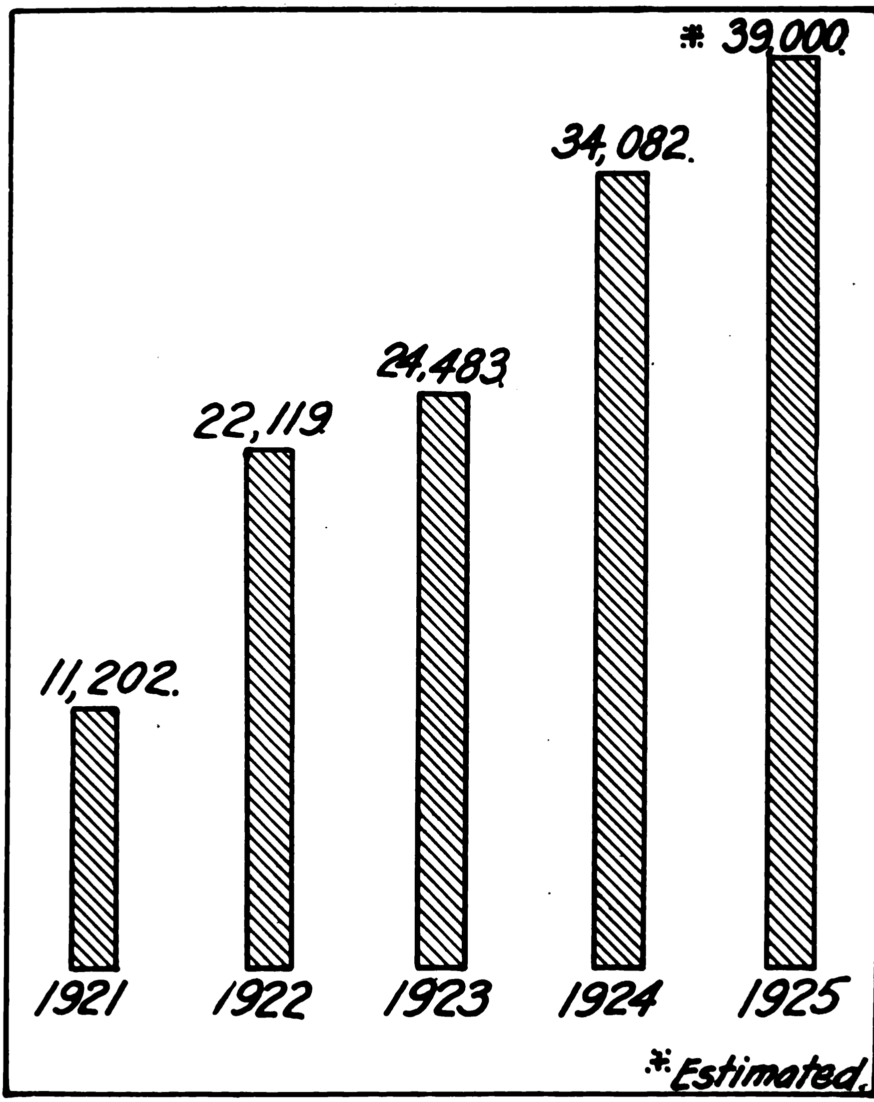
Season	Approximate Altitude of burst											
	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
Winter.......	0.00	0.19	0.29	0.38	0.43	0.49	0.52	0.55	0.56	0.56	0.54	0.50
Spring.......	0.49	0.53	0.54	0.56	0.59	0.62	0.63	0.64	0.64	0.62	0.59	0.54
Summer......	0.56	0.57	0.58	0.58	0.58	0.60	0.62	0.66	0.66	0.67	0.65	0.62
Autumn......	0.39	0.46	0.50	0.54	0.57	0.59	0.61	0.63	0.63	0.63	0.62	0.59

Bachelor of Science in Military Engineering

The following letter was recently received by the Adjutant General of the Army, from Dr. S. W. Stratton, President of the Massachusetts Institute of Technology.

> In view of the number of men from various branches of the Army and Navy services detailed to the Massachusetts Institute of Technology for instruction, and after consultation with several of the officials concerned, I am pleased to inform you that the Institute has established a course leading to the degree of Bachelor of Science in Military Engineering.
>
> This course is open only to officers who are graduates of U. S. Naval or Military Academies and to officers in the service who may have received their training at some technical school.

Comparative Enrollment
Civilian Military Training Camps
1921 - 1925



MILITARY NOTES

furnished by

THE MILITARY INTELLIGENCE DIVISION, G. S.

Great Britain

MEDICAL CORPS RESERVES.—It is announced by the British War Office that commissions in the Royal Army Medical Corps Supplementary Reserve of Officers are open to members of the medical profession engaged in civil practice. Medical officers in the Reserve are divided into two categories. Those in the first category (category B) have to undergo a preliminary training at the Royal Army Medical Corps Depot, except in the case of those holding certificates A or B medical of the Officers' Training Corps and an annual training of 14 days. Those in the other category (category C), which is intended for medical men with previous service and those possessing special professional qualifications, are not required to do either preliminary or annual training. The present requirements include a number of specialists in surgery, medicine, mental diseases, X-rays, pathology, bacteriology, and hygiene. The annual gratuity is 25 pounds, and those in category B receive in addition pay and allowances as for Regular officers during all training. An applicant's age should not exceed 32, except in special cases. The rank on appointment is that of lieutenant, corresponding to our grade of 1st lieutenant.

Japan

REORGANIZATION OF THE ARMY.—According to the *Jiji* of May 1, 1925, in conformity with the reform program, the peace establishment of the Japanese Army is to consist of 198,800 officers and men organized into seventeen divisions. This is a decrease of four divisions totaling 37,000 in personnel.

All the transfers, retirements and discharges from active service, resulting from the modernization and reorganization program, will probably have been accomplished by the end of the fiscal year, that is, by March 31, 1926. Should no increase be made in the meantime, the Army would consist of 15,540 officers and 183,260 warrant officers, noncommissioned officers and men. However, as a consequence of the creation of some new units such as antiaircraft battalion and tank companies, and the expansion of other units such as the Air Service, the strength of the Army will be between 198,800 and 205,400 at the end of the present fiscal year. The modernization and reorganization program which is to be carried out by April 1, 1930, calls for the addition of 6600 officers, warrant officers and noncommissioned officers and men, giving a total of 205,400.

Upon the completion of the Reform Program the Japanese Army, according to the *Jiji* will be composed as follows:

Infantry	*70 Regiments*	*706 Companies*	*Cos.*
17 Divisions of	4 Regiments of	10 Companies	680
1 Formosan Regiment of		10 Companies	10
4 Battalions Manchurian Ry. Guards		4 Companies	16
			706

Cavalry	*25 Regiments*	*70 Troops*
17 Divisions of	1 Regiment of 2 Troops	34 Troops
4 Ind. Brigades of	2 Regiments of 4 Troops	32 Troops
1 Mach. Gun Troop per each Ind. Cavalry Brigade		4 Troops

(The organization of Independent Cavalry Brigades as given in Japanese manuals calls for 2 regiments with 1 machine gun troop each, or a total of two for each brigade. However, only four Regiments belonging to Independent Cavalry Brigades actually have machine gun troops. If there are to be only 70 Troops, perhaps same change in the organization of Independent Cavalry Brigades as given in the manuals is contemplated.)

Field Artillery	*15 Regiments*	*90 Batteries*	
15 Divisions of	1 Regiment of 3 Bns. of	2 Batteries	90

(The 9th and 11th Divisions have Mountain Artillery instead of Field Artillery.)

Mountain Artillery	*4 Regiments*	*22 Batteries*
2 Regts. of 3 Bns. of 2 Btry. (9th and 11th Regts. in 9th and 11th Divisions)		12 Btry.
1st Ind. Moun. Arty. (Takata) 2 Bns. of 2 Btry.		4 Btry.
3d Moun. Art. (Ind.) (Kurume) 2 Bns. of 2 Btry.		4 Btry.
Formosan Moun. Arty. (Taihoku) 1 Bn. of 2 Btry.		2 Btry.

Horse Artillery	*1 Battalion*	*2 Troops*
Heavy Field Artillery	*8 Regiments*	*44 Batteries*
6 Regiments of 2 Battalions of 3 Batteries		36 Btry.
2 Regiments of 2 Battalions of 2 Batteries		8 Btry.

(7th and 8th Regiments, motorized, have only 2 Batteries per Battalion).

Engineers	*17 Battalions*	*48 Companies*	
14 Divisions of	1 Battalion of	3 Companies	42
3 Divisions of	1 Battalion of	2 Companies	6

Railroad Troops	*2 Regiments*	*16 Companies*	
2 Regiments of 2 Battalions of		4 Companies	16

Heavy Artillery			
3 Squadrons	*8 Independent Battalions*	*34 Batteries*	
3 Regiments of	3 Battalions of	2 Btrys. equals	18
	8 Battalions of	2 Btrys. equals	16

Telegraph Troops	*2 Regiments*	*15 Companies*	
1 Regiment of 3 Battalions of		3 Companies	9
1 Regiment of 2 Battalions of		3 Companies	6

(The 1st Telegraph Regiment has an additional Battalion, a wireless Unit.)

Air Service	*8 Regiments*	*26 Sq. (Cos.)*
	Pursuit Squadrons	11
	Reconnaissance Squadrons	11
	Bombing Squadrons	4

(Only the 1st 6 Regiments with a total of 16 squadrons are actually in existence although the establishment with a total of 16 squadrons are actually in 1925, has been officially announced. The 8 Regiments are to be completed by April 1, 1929 or 1930.) All Regiments, except the 7th which is the bombing unit, will probably be composite units and have both pursuit and reconnaissance squadrons.

Balloon Corps *1 Corps* *2 Companies*

(Only one Company is actually in existence. Another Company is to be added as a part of the Air Service expansion program embodied in the modernization budget.)

Transport *15 Battalions* *30 Companies*
15 Divisions of 1 Bn. or 15 Bns.

(The 19th and 20th Divisions in Korea do not have Transport Bns.)

Tank Troops *2 Companies* *40 Tanks*

(One Company officially established May 1, 1925 at Korauchi-mura, Fukuoka Prefecture. Tank units are to be completed by April 1, 1928 or 1929.)

Antiaircraft Troops *2 Battalions* *6 Companies*

First Battalion officially established at Field Artillery School on May 1, 1925, and removed to Toyohashi on May 7, 1925. Antiaircraft units are to be completed by April 1, 1930.)

Military Program: The *Jiji* of April 7, 1925, states that the principal object of the Japanese Army is mobile warfare; "that Infantry, in spite of the experiences of the European War, will remain the principal arm; that each Infantry Company is to be equipped with six (three at present) light machine-guns (automatic rifles with tripods), effecting a total increase of 1908 (*sic*) light machine-guns; that the odd numbered Cavalry Regiments belonging to the Cavalry Brigade are to be equipped with 16 machine-guns each, four (4) to each squadron; that range of field guns will be increased from 8,000 to 10,000 meters; that new guns will be furnished the field artillery; and that the supply of the foregoing arms is carried by the item in the Army Modernization and Reorganization Program for 'Improvement of Light Machine-guns, Ordnance, and firing material'."

India

STRENGTH OF ARMY: The following tabulation shows the authorized strength of the Army in India on April first of each year and the proportion of British and Indian troops; the actual strength varies slightly from month to month:

Year	British	Indian	Proportion of British	to	Indian
1919	85,989	228,295	27		73
1920	65,926	253,455	21		79
1921	69,559	150,822	32		68
1922	68,411	144,615	32		68
1923	68,563	143,446	32		68
1924	60,514	137,088	31		69

The total annual military expenditure in India during the years in question has been:

	Crores of Rupees	Approximate value in U. S. currency at present rate of exchange.
1919-20	83.00	$298,800,000.00
1920-21	81.75	291,870,000.00
1921-22	62.20	223,900,000.00
1922-23	67.75	242,100,000.00
1923-24	62.00	223,200,000.00
1924-25 (estimated)	55.48	198,900,000.00

The duties of the War Department General Staff shall be to prepare plans for national defense and the use of the military forces for that purpose, both separately and in conjunction with the naval forces, and for the mobilization of the manpower of the nation and its material resources in an emergency, to investigate and report upon all questions affecting the efficiency of the Army of the United States, and its state of preparation for military operations.—*John W. Weeks, Secretary of War.*

COAST ARTILLERY BOARD NOTES

Communications relating to the development or improvement in methods or materiel for the Coast Artillery will be welcome from any member of the Corps or of the service at large. These communications, with models or drawings of devices proposed, may be sent direct to the Coast Artillery Board, Fort Monroe, Virginia, and will receive careful consideration.—R. S. ABERNETHY, *Colonel, C. A. C., President Coast Artillery Board.*

New Projects Initiated During the Month of July

Project No. 366, 12-inch R. R. Mount, (Batignolles).—The Chief of Ordnance made recommendations regarding the correction of minor defects in the 12-inch Batignolles carriage and ground platform. The Board submitted comments on the proposed modifications and recommended an extensive service test of the 12-inch railway gun, model 1918, mounted on all-around fire pivot mount.

Project No. 367, Revision of A. R. 90-20 (Coast Artillery Board).—The Board was directed to revise this regulation to agree with the approved standard form of Army Regulation on the subject of Service Boards.

Project No. 368, Type of Field Desk for Coast Artillery Use.—The Board was directed to study and make recommendations on types of field desks for use by all organizations of the Coast Artillery Corps, including recommendations as to typewriters for field use (whether portable or standard should be furnished).

Project No. 369, Test of Moeller Binoculars.—Three models of the Moeller Binocular have been received for test by the Coast Artillery Board. These Binoculars are of interest because of their compact construction.

Project No. 370, Caliber .30 A. A. Machine Gun Sights (Comparative Test with Tracers).—The Board was directed to make a study of the relative advantages of sights and tracers in firing against antiaircraft sleeve targets. The Board conducted tests and found sights to be superior to tracers as a means of directing antiaircraft machine gun fire.

Project No. 371, Antiaircraft Fire Control Telephone.—The Board was directed to make a test of a system of telephones for transmission of fire control data from the range section to the gun section of A. A. gun batteries. This system was designed and is recommended for use by the Commanding Officer, Battery "B," 61st Coast Artillery

Project No. 372, Taliaferro Antiaircraft Machine Gun Sight.—The Board was directed to make a report on the sight designed by Captain E. H. Taliaferro, Jr., 61st Coast Artillery. This design provides for both lateral and vertical leads depending upon angle of approach and angular height.

Project No. 373, Apparatus and Method of Correlating a Sound Direction Finder and a Searchlight, Particularly for Antiaircraft Defense.—This is a study by Dr. E. B. Stephenson (Major, Engineer Reserve Corps) and submitted by him to the President of the Board for comment.

Project No. 374, Searchlight Project for Fort Story.—This project is an outgrowth of Projects No. 86 and 362 (Fire Control Communications Systems for Fort Story) which did not provide for searchlights.

Project No. 375, 105-mm. Antiaircraft Gun and Mount, Model 1925—The Chief of Coast Artillery directed the Board to submit comments on the design of the proposed 105-mm. antiaircraft gun and mount.

Project No. 376, Field Glass Allowances for 155-mm. Gun Regiments (National Guard).—The Chief of Coast Artillery directed the Board to make a study of the number of field glasses to be issued to 155-mm. gun regiments of the National Guard

Project No. 377, Tables of Allowances for Signal Corps Equipment and Supplies (Antiaircraft).—The Board was directed to submit comments on the question of communications for antiaircraft artillery and the allowances of communications equipment and materiel for the various organizations of A. A. Artillery.

Project No. 378, Plotting Room Equipment for First Sound Ranging Battery.—The Commanding Officer, 1st Sound Ranging Battery, Fort Eustis, Va., recommended that a more accurate plotting board be obtained for its use. He recommended also that a specially designed wind component indicator be constructed for use in sound ranging. This paper was studied by the Board and forwarded to the Chief of Coast Artillery recommending that steps be taken to secure the materiel desired.

Project No. 379, Artillery Recoil Mechanism Book.—The Chief of Ordnance has recommended the use of a recoil mechanism book similar to the present gun book. The Board was directed to submit comments on its desirability.

Completed Projects

Project No. 262, Drift and Cross Wind Charts for Mortar Deflection Board, Model 1906—

I—History of the Project.

1. The latest firing tables for the 12-inch mortar contain drift values which are more accurate than those given by the DeCarre drift chart. The tables also contain values of the effect of cross-wind on the projectiles. The Coast Artillery Board has constructed a chart which can be inserted in the mortar deflection board, Model 1906, and which gives better deflection correction values than the DeCarre chart.

II—Discussion.

2. All fixed mortar batteries are now supplied with mortar deflection boards equipped with the DeCarre drift chart. This chart is based to some extent on theoretical considerations. In view of the existence in the latest firing tables of

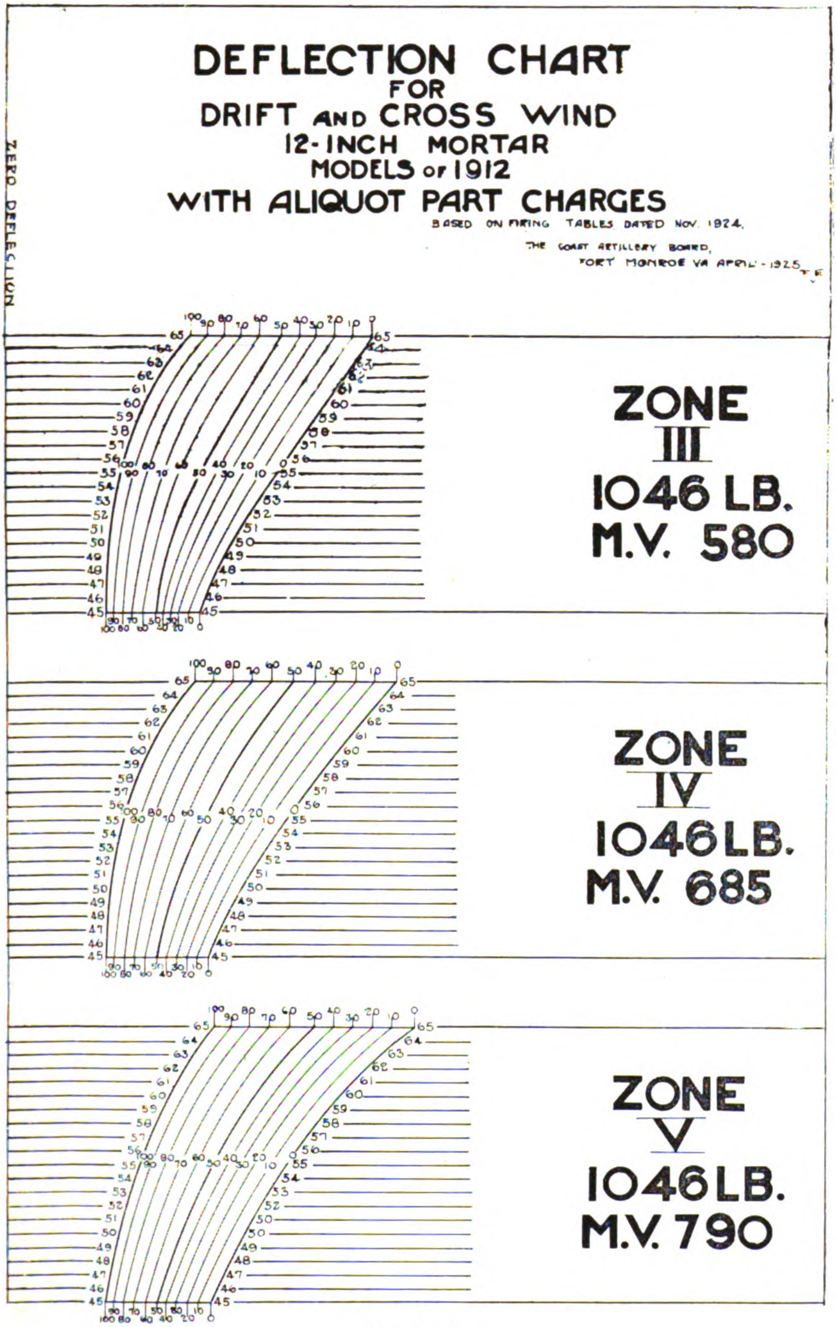

DEFLECTION CHART
FOR
DRIFT AND CROSS WIND
12-INCH MORTAR
MODELS OF 1912
WITH ALIQUOT PART CHARGES
BASED ON FIRING TABLES DATED NOV. 1924.
THE COAST ARTILLERY BOARD,
FORT MONROE VA APRIL - 1925
ZERO DEFLECTION
ZONE
III
1046 LB.
M.V. 580
ZONE
IV
1046 LB.
M.V. 685
ZONE
V
1046 LB.
M.V. 790

EXHIBIT A

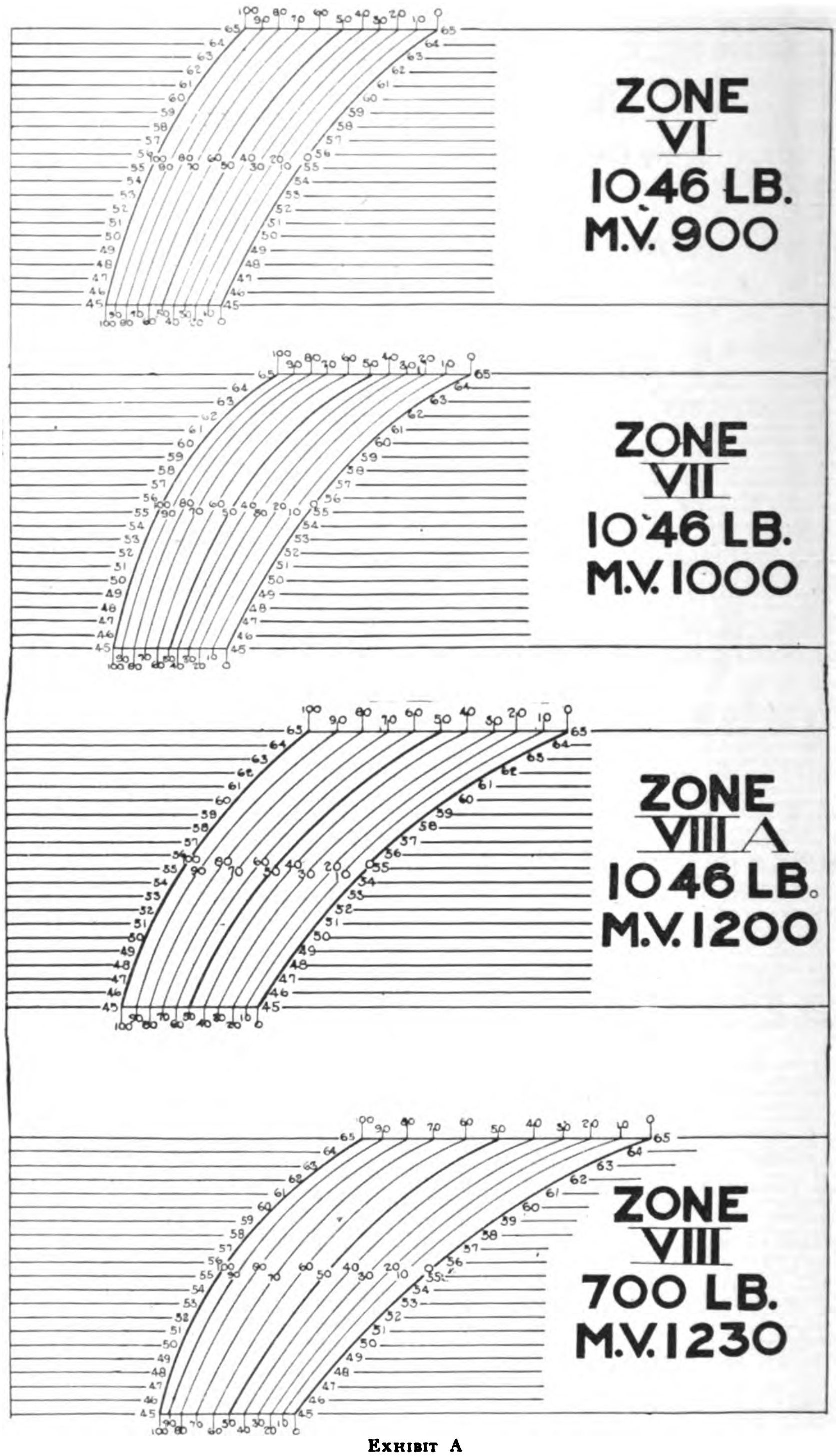

ZONE
VI
10.46 LB.
M.V. 900
ZONE
VII
10.46 LB.
M.V. 1000
ZONE
VIII A
1046 LB.
M.V. 1200
ZONE
VIII
700 LB.
M.V. 1230

Exhibit A

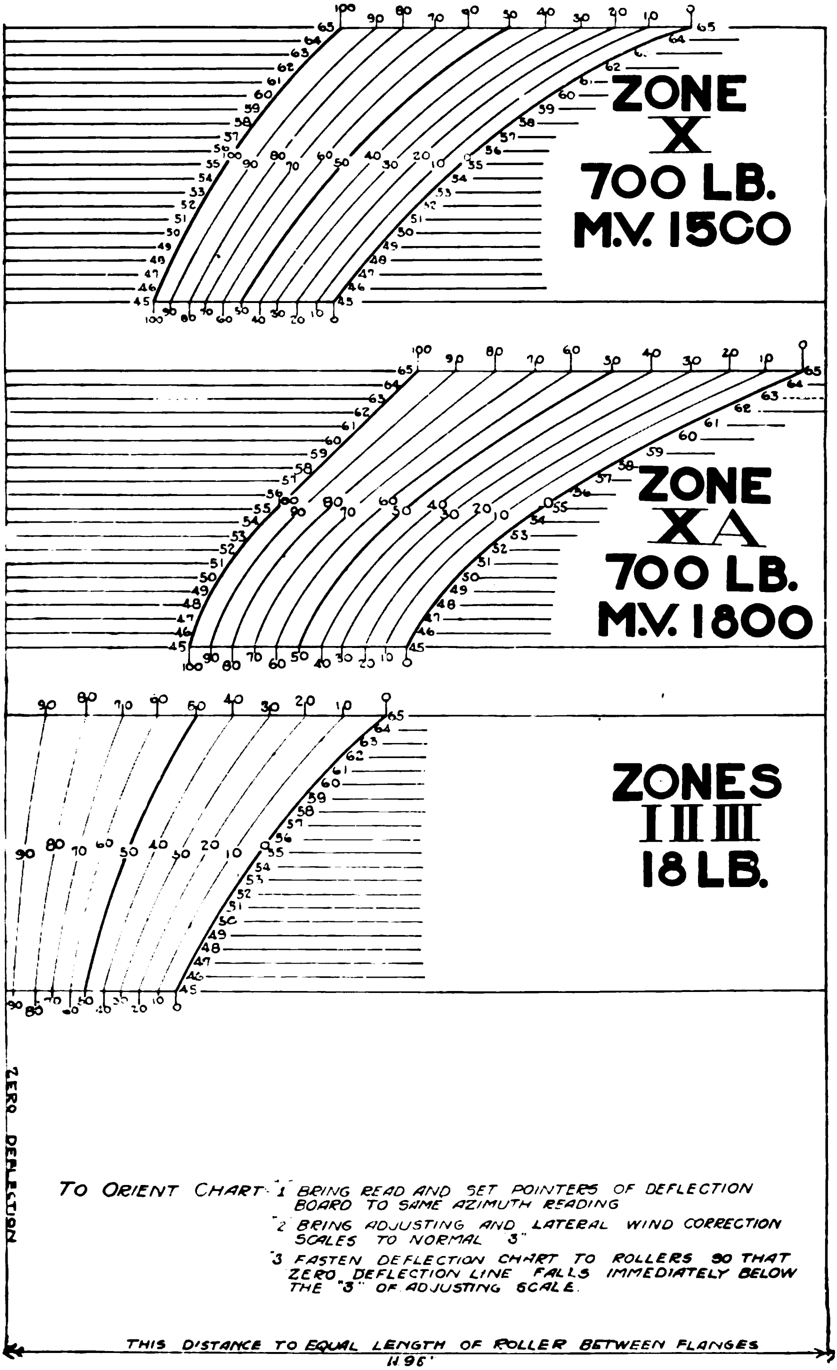

ZONE X 700 LB. M.V. 1500
ZONE XA 700 LB. M.V. 1800
ZONES I II III 18 LB.
ZERO DEFLECTION
TO ORIENT CHART 1 BRING READ AND SET POINTERS OF DEFLECTION BOARD TO SAME AZIMUTH READING
2 BRING ADJUSTING AND LATERAL WIND CORRECTION SCALES TO NORMAL "3"
3 FASTEN DEFLECTION CHART TO ROLLERS SO THAT ZERO DEFLECTION LINE FALLS IMMEDIATELY BELOW THE "3" OF ADJUSTING SCALE.
THIS DISTANCE TO EQUAL LENGTH OF ROLLER BETWEEN FLANGES
11.96"

EXHIBIT A

more accurate measured values of the drift, it would seem that a revision of the DeCarre chart is desirable. The Coast Artillery Board has accomplished this revision and has at the same time included in the chart a set of cross wind correction curves which permits the making of combined drift and cross wind corrections by the setting of a single pointer. Since the introduction of methods for measuring wind aloft, the desirability of making wind corrections in mortar firing has been recognized.

3. A copy of the proposed drift and cross wind chart for use with 12-inch mortars, Models 1890 MI and 1908, on the mortar deflection board, Model 1906, is shown in Exhibit A. This chart is operated in a manner similar to that used in connection with the range correction board. The chart is turned until the corrected elevation appears at the edge of the adjusting scale, and the *arrow* or *three* of this scale set at the proper cross wind reference number as read from the wind component indicator. As changes occur the operator moves the chart to the new corrected elevation and the pointer to the new cross wind reference number. Arbitrary corrections and corrections resulting from trial shots are applied on the so-called lateral wind correction scale. If wind measurements are not available, the pointer may be set on the *50* reference number curve, thus correcting for drift alone.

4. The chart could also be plotted with wind reference numbers along the side and elevation along the top. However, it is not believed that this method of plotting is as natural or as satisfactory as that used in Exhibit A. The rotation-of-earth correction in deflection for 12-inch mortars is almost neglible and does not appear on the proposed chart because the deflection board is so designed that it cannot be made conveniently unless applied as an arbitrary correction.

5. No mechanical change in the deflection board is required to use the proposed chart.

6. A similar chart was used during mortar firing at Fort Monroe and Fort Eustis. It was found to be satisfactory with the exception of minor changes which have been incorporated in the chart shown in Exhibit A.

III—Recommendations.

7. It is recommended that a wind and drift chart be adopted to replace the DeCarre drift chart, until funds are available to equip mortar batteries with a universal deflection board now being developed by the Coast Artillery Board.

IV—Action by Chief of Coast Artillery.

First Indorsement

War Department, O. C. C. A., January 26, 1925—To President, Coast Artillery Board, through Commanding General, 3rd Coast Artillery District, Fort Monroe, Va.

The recommendations of the Coast Artillery Board, contained in paragraph 7 of report on project No. 262, are approved.

Project No. 334, Ballistic Correction Charts for 12-inch Mortars Using Base Increment Type Powder Charges—

I—History.

1. Complete 12-inch mortar firing tables giving drift, cross wind and range correction values have not yet been supplied for the base increment type powder

charge but they have already been supplied for the new aliquot part type powder charge and the values placed in the latest approved range elevation, deflection, and range correction board charts. Some confusion therefore exists at batteries which are supplied with base increment type powder charges and aliquot part type charts and scales.

II—Discussion.

2. A single cross wind and drift chart is supplied for both D. P. and C. I. projectiles for the standard aliquot part charge for the 1890 and 1908 mortars. A single chart is also supplied for the 1912 mortar for the same kinds of projectiles and powder charges. In using such charts at batteries where only old type base increment powder charges are available, the chart zone to be entered depends on the normal base increment muzzle velocity.

3. The following table shows the aliquot part charge zone corresponding to each base increment charge zone when considering deflection corrections:

Table I

Weight of Projectile Lbs.	Base Increment Charge Zone	Base Increment Charge Velocity F. S.	Aliquot Part Charge Zone	Aliquot Part Charge Velocity F. S.
1046	III	660	IV	685
1046	IV	725	IV	685
1046	V	810	V	790
1046	VI	915	VI	900
1046	VII	1050	VII	1000
1046	VIII A	1200	VIII A	1200
700	VIII B	1250	VIII	1230
700	IX	1500	X	1500
700	X	1800	X A	1800

4. The battery commander, if supplied with only base increment charges can temporarily renumber the chart zones in accordance with the above tabulation so that the operator of the deflection board sees only the number corresponding to the base increment zone.

5. Logarithmic range elevation scales for 12-inch mortars are supplied separately for the D. P. and for the C. I. target practice projectiles for the aliquot part type powder charge. One range correction chart which is satisfactory for both types of projectiles for the aliquot part type powder charge is supplied for the 1890 and 1908 mortars and another is supplied for the 1912 mortars.

6. To use the aliquot part range elevation scale and range correction chart at batteries where only the base increment type powder charge is available the procedure can be as follows:

a. The battery commander can temporarily renumber the range elevation scale and range correction chart zone to agree with the base increment zones in accordance with Table I above. In addition the range correction chart can have the normal base increment velocity indicated by a penciled line parallel to the nearest constant velocity line of the chart zone.

b. The range correction board operator, using the temporary numbers, introduces a preliminary ballistic velocity correction corresponding to the difference between the normal aliquot part charge velocity and the actual base increment charge velocity as soon as the base increment velocity is computed or announced. The range elevation board operator also uses the temporary zone numbers for all of his settings. This procedure results in obtaining the proper

corrected elevation for the base increment charge. When complete firing tables have been supplied for the base increment charge range elevation scales, range correction charts and deflection correction charts will be supplied for the base increment charge to all batteries using this type of powder charge.

7. It is to be noted that the range correction and deflection correction charts now being issued by the Coast Artillery Board are based on the assumption that the 1046-lb. projectile is used in the inner zones in order to obtain the maximum effect on the target. The 700-lb. projectile is used in the outer zones to obtain as much range as possible, but with a consequent loss in effectiveness on account of the lower weight of projectile and high explosive charge. This makes the use of the 700-lb. projectile in the inner zones an emergency condition.

III—RECOMMENDATIONS.

8. It is recommended—

a. That the Coast Artillery Board be directed to supply a copy of this project to all 12-inch mortar batteries for which there are requested range elevation scales and range and deflection board correction charts.

b. That this project be brought to the attention of the Chief, Militia Bureau, for such action as he may desire to recommend.

IV—ACTION BY CHIEF OF COAST ARTILLERY.

First Indorsement

War Department, O. C. C. A., March 31, 1925.—To President, Coast Artillery Board, thru Commanding General, 3rd Coast Artillery District, Fort Monroe, Va.

1. Approved.

2. A copy of the report of Proceedings of the Coast Artillery Board on Project No. 334 has been forwarded to the Chief, Militia Bureau, for his information and such action as he might deem proper in the premises.

It is my firm conviction that the duty of National Defense, like the general duty of citizenship, should be broadly extended and borne by all our people.—*President Coolidge.*

BOOK REVIEWS

Robert E. Lee, the Soldier. By Major General Sir Frederick Maurice. Houghton-Mifflin Co., New York. 1925. 5⅞"x 8¾". 314 pp. with maps. $4.00.

Major General Sir Frederick Maurice is well known as a military writer, and was himself Chief of Operations of the British General Staff during the World War. After examination of the fields of Lee's battles and an exhaustive study of the literature relating thereto, he has written what he calls "an appreciation of Lee's generalship."

The author has prefaced his work with the remark:

> Lee, himself, said that his practice in battle was to bring his troops to the field in the best possible way and in the best possible condition and then to commit them to God and his subordinates. This has enabled me to deal very lightly with the stories of the battles and to avoid confusing the main lines of my portrait with details and military technicalities. It has also had the advantage that I have been able to escape almost entirely from those many controversies, which have raged round the performances of particular generals on various battlefields.

In speaking of Lee's strategy, he states:

> We find that Lee in his strategy employed three methods, each admirably adapted to the means available and to the political situation at the time. In the first period his policy was, as I have said, purely defensive. He was seeking time to prepare the means for bolder courses, for no one knew better than he that defense by itself is but a sorry weapon. In the second period he was seeking every opportunity to attack, not merely on the battlefields of Virginia, but in the territory of his enemy. He never forgot that he had seen from the heights of Arlington the domes of Washington. He believed that the surest way to cause the North to abandon the attempt to impose union by force of arms would be to seize the seat of the Federal Government, or at least to isolate it from the rest of the Union. So while defending Richmond he had always an eye upon Washington. Military critics are agreed that Napoleon's mastery of the art of war was never more completely displayed than in his first great campaign in Italy. Lee's Campaigns of 1862 are also supreme in conception, and have not been surpassed, as examples of strategy, by any other achievement of their kind, by any other commander in history. Both men had, when they were called to positions of responsibility, a complete grasp of the fundamental principles of war. There are in war few comparisons more striking than that between the inaction of the Southern forces after the first battle of Manassas and Lee's energy, promptness, decision, and boldness in action after the second battle at the same place. True, as I have shown, Davis must take his share of blame for the loss of opportunity in 1861, but in 1862 the President was the same, it was the soldier who was different. One is forced to the conclusion that his absence from Davis' side at this time was fraught with consequences. The evidence is clear that the hastily formed levies of the Confederacy of Manassas were almost as much discouraged by victory

> as were the Federal troops by defeat, and Davis had made out for himself a good answer to the charge that he was responsible for stopping an immediate pursuit. But when order had been restored and the unreadiness of the Union was revealed, it is hard to believe that Lee, if he had been given the chance, would not have galvanized the leaders of the Confederacy into action before the winter set in. The troops flushed with victory needed no spur.
>
> The third period of the war, reckoned from the point of view of a consideration of Lee's strategical methods, dates from the failure at Gettysburg. After the battle Lee saw that the growing power of the North and the increasing determination of its people made it impossible to force them to abandon the struggle by an offensive campaign in the border States, even if that campaign were successful. Henceforth the policy for the South was to endeavour to convince the North that the subjugation of the Confederacy was either a task beyond their means or one which would bring them more loss than gain. Lee's procedure was then, not as in the second period to seek to force a decision by boldness and enterprise, but to avoid decision and to cause delay. The Campaign of the Wilderness, of Spottsylvania, and the North Anna is a classical example in military history of how these objects should be sought. In method it 'was fifty years ahead of the times, and I believe that if the Allies in August, 1914, had applied Lee's tactical methods to the situation which then confronted them the course of the World War would have been changed.

General Joseph E. Johnston, Lee's classmate and close personal friend, the author consider a "good ordinary general," and cites the fact that "when McClellan was hammering at the gates of Richmond, Lee saw that the way to save the town was to make McDowell defend Washington; Johnston waked only to the prospect of a battle with McClellan. There we have a measure of the intellects of the two men." But later on in speaking of the mistake President Davis made in removing Johnston, in front of Sherman in June, 1864, he says, next to Lee, Johnston was the ablest soldier the Confederacy *then* had.

The British are sincere admirers of Stonewall Jackson, perhaps largely because of Henderson's brilliant "Life of Stonewall Jackson," and General Maurice is no exception to the rule. He however says:

> It is unnecessary for me to add my quota of praise of Jackson's conduct of the Valley Campaign. Without his tactical skill, fierce energy, and instant comprehension of what was in Lee's mind, Richmond could not have been saved in 1862. But save only in the retreat down the Valley, and in the battles of Cross Keys and Port Republic, the inspiration had in every case come from Lee. For that phase of the campaign the credit must be Jackson's alone. For the initiation of the enterprises which had kept McDowell from Richmond, and brought Jackson to fight CcClellan, Lee was responsible, and his daring yet measured planning in adversity displays a degree of enterprise and of strategical ability which has never been surpassed.

Of Longstreet, he says:

> Longstreet was an obstinate man. It may be that the experience of Malvern Hill weighed heavily on him, but it is clear that he was obsessed by one idea. He believed the recipe for victory to be to maneuver an army into a position such that the enemy would be compelled to attack at a disadvantage, and there await the blow. That belief of Longstreet's and consequent unwillingness to attack was later to be disastrous to the Confederate cause, and it is at least probable that it saved Pope's army from annihilation on August 29th. Longstreet had in front of him Porter with very inferior numbers and was so placed that he could have speedily enveloped Porter's flank. Curiously enough, while Lee was pressing Longstreet to attack, Pope, who appears to have been unaware that Longstreet's whole force was in the field, was doing the same thing to Porter, who prudently refrained from so desperate a measure until he had more certain informa-

tion of the force opposite him. After the battle Porter was dismissed for failing to do the very thing that Longstreet hoped he would do. A share of the responsibility for Longstreet's inaction must be Lee's. One of the few defects of his generalship was a curious reluctance in battle to back his own judgment against that of his chief subordinates and to enforce his will upon them. It is a hard thing for a commander to draw the line correctly between undue interference and excess of liberty. Lee once described the principles which guided his conduct in battle. "My interference in battle would do more harm than good. I have then to rely on my brigade and division commanders. I think and work with all my power to bring the troops to the right place at the right time; then I have done my duty. As soon as I order them forward into battle, I leave my duty in the hands of God." This, as a system of command, is sound to a point. It is entirely applicable to the commander-in-chief of such huge armies as fought in the Great War, but in forces of the size which Lee commanded some more direct intervention when battle is joined is sometimes necessary. Lee was disposed to err on the battlefield in not asserting his authority enough. He suffered, as the French say, from the defects of his qualities, for it is probable that, if his character had allowed him to be more assertive, he would not have inspired in those he led the devotion which made them endure as men have rarely endured.

After comparing Wellington and Lee the author closes with:

> For these reasons then I place Lee as a general above Wellington. "Read and re-read!" said Napoleon, "the eighty-eight campaigns of Alexander, Hannibal, Cæser, Gustavus, Tuerenne, Eugene, and Frederick. Take them as your models, for it is the only means of becoming a great leader, and of mastering the secrets of the art of war." To that select band of great commanders the name of Robert E. Lee must be added. His exact precedence amongst them I will not attempt to determine, but that they have received him as a soldier worthy of their fellowship, I do not doubt.

The book is delightful reading; it is not a work of simply praise here and criticism there, but an enthusiastic study, largely through the eyes of Lee as shown in *Lee's Confidential Despatches to Davis,* which were published in 19915. "The Profession of Arms" will find it instructive and of absorbing interest. —W. W. I.

The United States and the Philippines. By D. R. Williams. Doubleday, Page & Co., Garden City, N. Y. 1924. 5¾"x 8½". 325 pp. $3.00.

Judge Williams' book on the American-Philippine relations is, perhaps, the most authoritative book that has appeared on the subject. He was Secretary to the Taft Commission that went to the Philippines in 1900, later served on the bench in the islands, and has lived in the Orient for more than twenty years. He writes, therefore, from long personal contact with the Philippine peoples, as well as from a profound study of their problems.

His book begins with a treatise on the Far Eastern situation as a whole in 1898, with particular reference to the influence exerted by America's entrance on the Asiatic stage on the plans and ambitions of Japan and certain European nations. He then records the story of our entrance, followed by a vivid history (political and economic) of the islands since. He portrays in an interesting and illuminating manner the inherent qualities of the Filipino and the characteristics of the Philippine political leaders.

Most American citizens are not familiar with the history of the recet opposition to General Wood, nor are they aware of the fact that a widespread Philippine Independence propaganda in America was financed by public funds.

Judge Williams covers these matters fully. He arrives at a very definite conclusion as to the future of the Philippines and does not mince matters in the support of his conclusion. His book should be read by every American citizen who would be informed on this problem.—C. S. H.

Far Harbors, Around the World. By Hubbard Hutchinson. G. P. Putman's Sons, New York. 1924. 6¼"x 9¼". 324 pp. $3.75.

If any Army Officer intends to postpone his foreign service tour, let him beware of this book, for having read it, he will be eager to start at once.

The author takes you away from the tourist's trodden path and to out-of-the-way and unusual places. With him you climb to the watch towers of the Great Wall of China, or gaze at the Southern Cross from a moon-lit deck on tropic seas.

If you wish to take a voyage de luxe, having already decided against foreign service, get a copy of this book, an easy chair and be off to the land of your dreams.—L. M. C.

Fundamental Principles of Generators and Motors; Examples. By Prof. F. E. Austin. The Author, Hanover, N. H. 1924. 5"x 8". 108 pp. Ill. $2.50.

A handy little book giving a clear concise treatment of the subject. The aim of Prof. Austin in this volume, "to consider qualitative phenomena and principles as well as quantitative results, with their relations as regards efficiency," seems to have been attained.

The author introduces his subject with a chapter on induced currents explained in an interesting and somewhat novel manner. He then discusses the principles of the various types of generators and motors laying special emphasis on power efficiency. There are included several applications of Calculas to obtain expressions for the maximum commercial efficiency which are useful and, while the method may not be understood by the reader, the results obtained will be readily understood and can be used by any one interested in this subject. The subject of efficiency is attacked from various angles, all-day, mechanical, electrical and financial. The discussion of costs and financial efficiency will give to the reader a good idea of what size motor to buy and at what load to operate a motor to get the best results. The importance of the first cost of motors is explained.

The principles are well illustrated with simplified diagrams and all of the theoretical calculations are made evident by numerical examples. A set of wire tables is included.

This book should be of value to the engineer. It should be a great help to the instructor in teaching this subject and will give to the engineering student a clear conception of the fundamental principles of generators and motors.—R. W. A.

These United States, a Symposium. Edited by Ernest Gruening. Second Series Boni and Liveright, New York. 1924. 5½"x 8½". 438 pp. $3.00.

When the first volume, or First Series, of these highly critical papers appeared to present a reflection of the condition of the nation in somewhat sharply drawn portraits of the several States, reviewers kindly fore-warned those who might wish to cherish smugly sentimental illusions. The same consideration might be shown those who may chance upon this Second Series, for the treatment is entirely similar in tone.

The key-note of the complete series might well be found in William Allen White's "What"s the Matter with Kansas," and the editor may possibly have had

that suggestion in mind in opening the first volume with a contribution by the analytical Kansan. "Kansas: A Puritan Survival," leads the way, followed by "Maryland: Apex of Normalcy," by none other than the celebrated Mr. Mencken, in what is probably the most normal of his published essays. "Mississippi: Heart of Dixie," "Ohio: I'll Say We've Done Well," by no less an analyst than Sherwood Anderson, and others in their turn more or less spectacular, comprise the First Series, which appeared about a year ago.

It may be possible that the editor felt some twinge of conscience at the shattered story-book and school-history images of the various commonwealths exhibited in the first volume, for his choice of an introduction to the second is "Virginia: A Gentle Dominion," a comparatively softened treatment of this, as it is called, "garden of memories," in the Corot manner. Sinclair Lewis offers a rather colorless portrait of "Minnesota: the Norse State," and others, perhaps less widely known, contribute "Florida: The Desert and the Rose," "West Virginia: Mine Field Melodrama," "New Hampshire: Not Yet Abandoned," "Wyoming: the Maverick Citizenry," "North Carolina: A Militant Mediocracy," "Oklahoma: Low Jacks and the Crooked Game," "Kentucky: Where Men Die Standing," and "Indiana: Her Soil and Light," by Theodore Dreiser, but lacking, strange to say, the Dreiser touch. Montana, Illinois, Idaho, New York, Washington, New Mexico, Rhode Island, Missouri, North Dakota, Georgia, the District of Columbia, Alaska, Porto Rico, and Hawaii are all portrayed through the favorite spectacles of their investigators; why the Philippine Islands has been omitted is not explained, but certainly not because material for the most caustic word-artist is lacking.

It may be observed that the sub-titles tagged to the States are arresting. So are the articles. Few lack the cynic's touch, or perhaps it would be more charitable to say that the portraits have emphasized the warts, according to the angle of the artist's point of view. To Army people, who may be said to pride themselves upon seeing things as they are, a reading would be more convincingg than refreshing; to any one possessing a good digestion and a well-balanced critical sense, the book would be productive of a far clearer vision of these United States than any premeditated investigation from the window of a Pullman car, or even, perhaps, from the hurricane deck of the family Ford.—K. S. P.

Einstein's Theory of Relativity (*Third Edition*). By Max Born. Translated into English from the German by Henry L. Brose, M. A. E. P. Dutton & Co., N. Y. 293 pp. $5.00.

This is an excellent popular work on relativity. Its purpose is to give a reader having a knowledge of mathematics limited by elementary algebra, an outline of Einstein's theory of space and time. The method used is the semi-historical one. In the first two-thirds of his work the author endeavors to prepare the reader for an understanding of the theory by presenting the fundamental conceptions and facts of physics in popular form. It is by stressing the physical basis that he leads up to relativity. He explains how it was necessary for relativity to be developed in order not to hinder the development of physics.

The material appearing in the book was first brought out as an elaboration of a series of popular lectures on relativity which Professor Born gave in Germany during the winter of 19919-20. At that time the English astronomical expeditions had just confirmed one of the predictions of the theory of relativity, thus giving a sudden impetus to public interest in the theory. In this, the third edition, the treatment of Einsteinian relativistic dynamics has been simplified to a certain extent.

The book may be classed between those works which avoid all mathematical explanation and those which include too much mathematics for even the reader who has had a scientific training. It will be most interesting to one who is fresh from a college course in physics, or to one who on account of the scientific or technical nature of his work is compelled occasionally to use his knowledge of physics. It must be read slowly and perhaps two or three times to get its full value, but the time will be well spent. The theory of relativity is the greatest scientific achievement of the age. It is the final picture of the world presented by science at the present day. It is a guiding thread in the most important regions of physical research. It has an interest reaching far beyond mathematics and physics into realms of philosophy. Anyone who is interested in science should desire to have a glimpse of these new and broader concepts of the universe and reality.

The translation is good and the illustrations sufficiently numerous. The first five chapters give a very good review of physics and its unsolved problems. The last two chapters which are devoted entirely to the new ideas introduced by relativity are not very easy to absorb at first reading, because of the detailed logical reasoning. The material in the book is a fitting sequel to a course in physics of the junior or senior college year. Whether or not a complete understanding is obtained from the book—this can hardly be expected—nevertheless one connot escape many of the conceptions of space and time which in themselves are the important and interesting things connected with the theory.—P. S.

The German Secret Service. By Colonel W. Nicolai, Chief of the German Intelligence Department during the World War. Stanley Paul & Co., London. 5¾"x 9". $2.50.

This book is a clear and concise account based on the author's experience of the activities of the German Intelligence before, during, and after the war. Disregarding the propaganda features, it is an interesting narrative. Beginning with the historic development of Espionage, the author then takes up the preparation for war insofar as they relate to the training of the intelligence officer and of the Intelligence Service. In showing what the Germans had to combat, he describes the French, Russian, and British Intelligence Services and freely states that France and England had better organized and functioning services before the war than did Germany. Succeeding chapters deal with the Outbreak of War, the Eastern Front, the Western Front, Secret Service in neutral countries, and an interesting chapter on Espionage in the Homeland, in which he sadly states the large number of Germans employed as spies by the Allies, chiefly by England, to operate in Germany. The concluding chapter shows the breakdown of this service after the war, and the author deplores the fact that Germany learned little of the value of intelligence as a political and economic asset, as in her post war organization it plays as small a part as it did before the war.

Germany seems to differ little in this respect from our own government.

The book is of special interest to any one who is a student of the subject, and it is very interesting for the general reader.—W. W. H.

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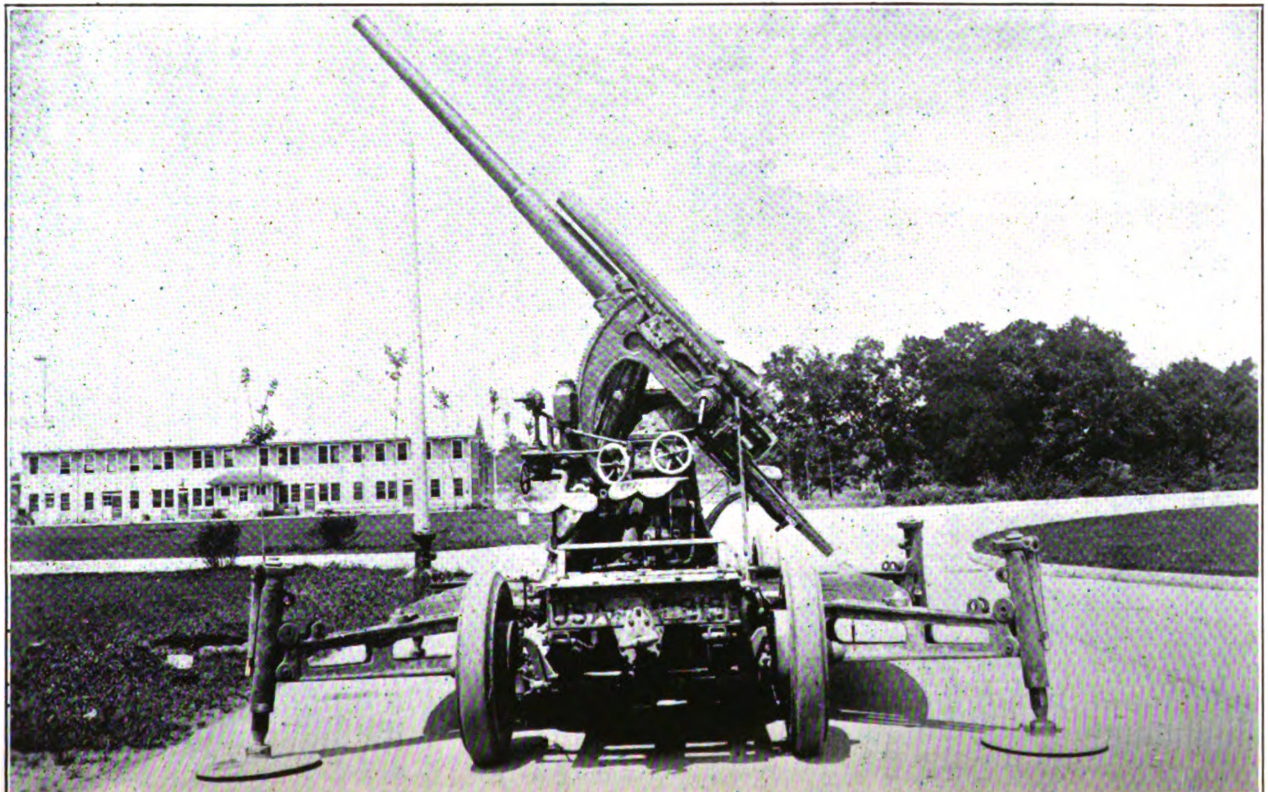

3-INCH A. A. GUN, MODEL 1920-E—MV 2600 F. S. *For complete description* *see p. 273*, COAST ARTILLERY JOURNAL, *September, 1924*

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Battle Training for Coast Artillery

By MAJOR E. J. CULLEN, C. A. C.

THE ultimate purpose of all military training is the development of battle efficiency. Target practice is but a form of military training that utilizes to advantage certain deep seated instincts common to all mankind. There is something in the human psychology, inherited perhaps from our cave-dwelling ancestors, that fills man with a keen desire to compete with his fellow-men in a test of skill in the use of weapons. This inherent urge of the individual is utilized to excellent advantage in the training of the soldier in the use of small arms. The soldier is encouraged and assisted to demonstrate his skill in competition with his fellow soldiers. But the primary purpose of this competition is to accomplish the training of the soldier, and the records of the competitors are of use merely as indications of the degree of training that has been accomplished. In other words target practice is primarily a means for the accomplishment of training rather than a test of the training accomplished. Another and even more important fact that should be borne in mind is that the development of individual proficiency is but the initial training necessary to prepare the soldier to play his proper part in the battle team, for team-work is the keynote of all battle efficiency, and battle efficiency is the ultimate purpose of all military training. The coast artillery officer readily realizes the importance of team work, for his every-day life is filled with the problems of "building up the team." But we of the C. A. C. should not limit our efforts solely to building up the "Battery Team," which is but a single unit in any artillery battle team. We must extend our efforts beyond the training of the battery units and strive to accomplish the training of the battle team as a team.

The battle efficiency of artillery is dependent upon two essential elements, namely, proficiency in fire technique and proficiency in fire tactics. Fire technique, frequently referred to as gunnery, is the technical operation of the fire units, the batteries. Fire tactics is the tactical employment of the combined fire power of these units.

In target practice we possess an opportunity for developing both the proficiency of the individual units in fire technique and the proficiency of the battle-team in fire tactics, that combination which is the basis of the battle efficiency of artillery. Coast artillery target practice should have for its purpose the development and test of proficiency in fire technique, and the development of proficiency in fire tactics. Furthermore, in order to insure the practicability and general effectiveness of the battle plans devised for use in the defense of a given locality, and in order to develop that team-work so essential to success in battle, there is need for a comprehensive program of progressive target practice for each harbor defense command. Such a program constitutes one of the principal means available for battle training. But the greatest handicap that could be encountered in battle training would be the lack of sufficient personnel and of sufficient ammunition. From the lack of sufficient personnel, we would be compelled to sacrifice certain measures which are essential in the fire action of modern battle. From the lack of sufficient ammunition we would be deprived of the opportunity of obtaining that volume of fire, the study of the effectiveness of which would afford a clear insight as to the deficiencies and inaccuracies of the various methods employed, both in fire technique and in fire tactics.

The first essential element of battle efficiency is that degree of proficiency in fire technique that will insure the complete and immediate effectiveness of the fire delivered against the designated target. Effectiveness of fire is the direct result of a volume of fire, delivered with precision against a designated objective during a given period of time. As a factor of effectiveness, volume of fire is related primarily to the character and size of the objective, but it also exercises a controlling influence upon the degree of precision that is attainable in that firing. Precision demands freedom from error, but the highest standard of accuracy possible in artillery fire-action is compelled to accept the presence of many indeterminate residual errors in the attendant operations. If precision is to be accomplished, the resultant effect of these indeterminate residual errors must be evaluated and the necessary compensation made. All accepted methods for the mathematical treatment of these indeterminate errors require the use of a reasonably reliable "mean value" obtained from the observation of actual results. The degree of precision that can be accomplished in the artillery fire-problem must depend, therefore, upon the volume of fire, since the number of shots that can be observed will exercise a direct influence upon the reliability of the "mean value" employed in the treatment of the indeterminate residual errors in the problem, and thereby upon the degree

of precision that can be accomplished. The relative reliability of "mean value" is as the square-root of the numbers of observations employed. The relative reliability of the "mean value" obtained from four observations is "2." In other words it may be stated that four observations will permit of a "mean value" that is twice as reliable for use in the treatment of indeterminate errors as is the value obtained from a single observation. It is generally accepted that four observations will afford a "mean value" that is reasonably reliable for artillery purposes. In testimony of this fact, we find the four-gun battery in general use by the artillery of most armies. This battery will deliver a salvo that affords four observations from which to evaluate the "mean value" of the effect of those indeterminate errors that are always present despite accurate preparation. With the heaviest calibers, where time and facilities are available for the most accurate preparation of firing data, it is possible to attain satisfactory precision of fire by the use of the two-gun salvo. But since the relative reliability of the "mean value" obtained from this salvo is less than that obtained from the four-gun salvo it may be expected that a greater number of salvos will be required to accomplish the same degree of precision as that attained by the four-gun battery, assuming of course equal accuracy in the preparation of firing data. The only reduction of ammunition allowance that is justifiable is that rather indefinite amount that may be saved through the employment of increased accuracy in the preparation of firing data for the heavy caliber batteries. It is generally accepted in artillery practice that four to nine salvos are required in order to positively accomplish a fair degree of precision of fire. In any case, unless the allowance of ammunition is sufficient to permit of the accomplishment of precision of fire, we shall have lost all opportunity of attaining a high degree of proficiency in fire technique.

In order to develop the necessary proficiency in fire tactics there must be an effective system of battle training that will include a progressive series of problems relating to the various situations that will be encountered in the execution of the approved battle plans for the general defense of the given locality. These problems must be free from all false assumptions and hypothetical conditions, that is to say, that in so far as possible, they must be based solely upon the actual conditions that would exist in battle. It is possible and highly desirable to utilize target practice as a means for the development of proficiency in fire tactics, by conducting a series of firing problems relating to tactical situations incident to the defense of a given locality. But these problems must be conducted with sufficient personnel to completely man every element of the command that

would be required to play a part in the action in actual battle. Furthermore, there must be sufficient ammunition available to insure conclusively the proper functioning of all the elements of the command involved in the action, the interferences that would be encountered, the cooperation that would be essential to success, and in general the actual results that would be accomplished in battle.

Today, with our present military policy of one Army, a team composed of the Regular Army, the National Guard, and the Organized Reserve, we are faced with the necessity of devising effective means for the training of that battle-team as a team. It is the team upon which the nation relies for success in war, and that success can be insured only through the development of maximum battle efficiency. The individual units that constitute this team must be equally proficient as elements of the team, and the team must be assembled and trained as a team, for that is the only possible method of developing team work, and team work is the keynote of battle efficiency. The time has arrived when we should consider changing from the present system by which we are now attempting to train separately the Regular Army, the National Guard and the Organized Reserves, each as a distinct entity within itself. We should devise some thoroughly coordinated system of battle training capable of developing the maximum battle efficiency of the complete battle-team assigned to the coast fortifications of each given locality. The required system must be designed to inculcate and develop the true spirit of cooperation and mutual reliance between component parts of the team, the Regulars, the National Guard, and the Reserves—that spirit which is most essential to the successful accomplishment of team work. Furthermore, this required system must be fully capable of developing the maximum proficiency in fire technique and fire tactics, and must provide a means for the thorough test of the battle plans adopted for the defense of each given locality. It is believed that all the facilities necessary for inaugurating and developing a battle training system of this scope and character, are made available by the authority now granted to Corps Area Commanders, the Chief of Coast Artillery, and the Chief of the Militia Bureau, under the provisions of paragraphs 33, 34, and 35, Training Regulations No. 10-5. The full and complete development of the battle efficiency of our harbor defense commands awaits the adoption of some system of combined battle-training for the component parts of the coast artillery of the Army.

The supervision of the training of all units of the Regular Army, National Guard, and Organized Reserve located within a given Corps area is vested in the Corps Area commander. One pos-

sible solution of the coast artillery battle training problem is to combine all the coast artillery organizations (fixed artillery, railway artillery, tractor artillery, and antiaircraft artillery of the three component branches) located within a given corps area, to constitute a unit battle team. This team could be trained each year for a definite project pertaining to the harbor defenses of a selected locality within the corps area, and this training could be conducted under the direct supervision of the coast artillery district commander, who as a staff officer, represents the corps area commander in all matters pertaining to coast artillery. By selecting each year as the basis of the training project a harbor defense command other than utilized the previous year, but within the same corps area, the entire coast defense problem, in so far as it pertains to coast artillery, could be covered within a reasonable time. Furthermore, it is believed that this change each year would serve to stimulate interest in the work entailed.

An annual training project for the utilization of the entire coast artillery personnel within the corps area for service at a specified harbor defense command, could be instituted in each coast artillery district. The extensive personnel available will permit of devising a training project based upon the employment of the complete war-strength organization of the selected harbor defense command. Ample personnel will be available for assignment to every element of the artillery defense in the selected locality; fixed batteries, mobile batteries, mines, searchlights, and communications; together with the commanders and staffs for the various sub-commands thereof. All organizations, both Regular Army and National Guard, could be given specific assignments in the designated harbor defense command. These assignments could be based upon the character of the organization, those pertaining to the fixed armament being assigned to various batteries in accordance with the type and caliber for which they have been previously trained. The mobile units, railway, tractor, and antiaircraft artillery should be assigned to the specific functions allotted to these classes of armament in the general defense plans of the selected locality. All available field and staff officers of the Regular Army and National Guard and all Reserve officers could be assigned to specific duties with the various units, staffs, and sub-commands of the designated harbor defense command, in accordance with their capabilities and the requirements of the battle organization. Similar assignments of the warrant officers and enlisted specialists could be made. Any individuals or units available after complete assignments have been made to each and every element of the designated harbor defense command, could be assigned as

alternates for specific duties with the various elements of the command. The definite assignment of each and every individual and unit would insure their proper training and preparedness to execute the functions required of them as members of the complete battle team.

The training program for the accomplishment of the annual training project should provide such special training of the various individuals and units as may be necessary to insure their maximum battle efficiency. The program should have for its ultimate object the development of a uniform high standard of proficiency of all individuals and organizations and it should prepare them in their proper functions as members of the battle team of the harbor defense command designated in the project. The program should provide for the training and preparation of all individuals and units at their home stations and armories throughout the entire year, and finally for the mobilization of the entire command at the designated locality in order to accomplish the battle training through a course of battle exercises.

At the home stations and armories provision should be made for the accomplishment of the special training of individuals and organizations that may be necessary to correct all previously demonstrated deficiencies and to develop a high standard of individual proficiency. This training should take the form of drill and instruction in the operation and maintenance of the armament and fire control equipment to which assigned, gunner's instruction, and subcaliber firings. Special arrangements could be made for sub-caliber practices and night drills for National Guard organizations at nearby fortifications throughout the year, at times and places convenient to the personnel.

Special training should be provided in order to familiarize the personnel of each organization with all the details pertinent to the battery or other element of defense to which assigned in the training project. This training and instruction could be conducted at the home station or armory of the organization, and could be accomplished through the medium of lectures and the study of all the necessary maps, charts, diagrams, and photographs pertaining to the defense element to which assigned. Harbor boats and mine planters could be utilized throughout the year for the transportation of selected personnel of the various Regular, National Guard, and Reserve units for short visits to the designated localities. This would afford the opportunity of personal observation of the battery emplacements and other essential features of the local situation.

The special training of individuals and organizations with reference to the tactical employment of their battery or other assigned

element of the defense could be accomplished at the home stations and armories through the medium of the coast artillery war game or other suitable means. Conferences on the subject of the tactical functions and the employment of the assigned element in the various phases of the general defense of the designated locality could be conducted by specially trained officers designated by the coast artillery district commander.

Special training should be provided for all officers, Regular, National Guard, and Reserve, in addition to the training received with their organizations. For battery officers this special training should include a short course of instruction in the gunnery problems pertaining to their assigned type of armament and detailed instruction in the operation and maintenance of this materiel. For field and staff officers this special training should include instruction concerning the general and special defense plans, mobilization plans and battle plans pertaining to the locality designated in the training project, and their duties as commanders and staff officers in the various tactical situations therein. The instructors necessary for the special training of the officer personnel should be carefully selected and prepared for this duty, preferably under supervision of the coast artillery district commander. This class of instruction should be coordinated in the various commands, in order to conform to the local training programs and schedules. The keynote of successful battle training of coast artillery personnel is to be found in the careful and complete supervision and coordination of the training by group commanders, fort commanders, and harbor defense commanders.

The annual training program could be concluded by a complete mobilization and concentration, at the designated harbor defense command, of all the coast artillery personnel in the corps area (Regular Army, National Guard, and Organized Reserves). This mobilization could be utilized for the development of the team-work of the coast artillery battle team, and for the test of the battle plans adopted for the general defense of the selected locality. The program for the mobilization period could provide also for the thorough inspection of each element of these fortifications in order to insure the operating efficiency of the materiel, and the completeness of the equipment on hand. By suitable arrangement with the local naval-district commander, the cooperation of the naval patrol service in the selected locality might be obtained, which, together with the services of the available army air forces, would place the entire mobilization upon a complete war basis. Prior to mobilization day the harbor defense command designated in the annual project could be

placed in a complete state of readiness by the local garrison. All armament, fire control stations, searchlights, and all other elements of the defenses could be made ready for immediate service. The entire allowance of ammunition provided for the annual target practices of all Regular, National Guard and Reserve coast artillery units in the corps area, together with the necessary targets and towing vessels could be assembled at this place, available for use during the mobilization period. The necessary measures should be provided thereat to insure the complete and efficient administration and supply of the entire war-strength command. In other words, thorough preparation could be made, prior to mobilization day, to place the designated harbor defenses in full and immediate readiness for war.

The mobilization and the training of the assembled command could be conducted in accordance with a carefully prepared program instituted by the coast artillery district commander. The movements of all organizations, both fixed and mobile artillery (Regular, National Guard and Reserve), to the designated locality could be made in conformity with a definite prearranged plan designed to place the selected harbor defenses upon a complete war footing in case of emergency. The battle training of the assembled command during the mobilization period could be conducted in accordance with a program that would afford the exercises and the service firings necessary to develop proficiency in fire technique and in fire tactics.

The first week of the mobilization period could be devoted to the disciplinary training and special instruction of individuals; to the drills and tactical problems, involving sub-caliber firings, necessary for the development of team work in the various batteries, groups and forts; and to the conferences and lectures for all officers on the general defense plans and other matters relating to the battle efficiency of the command. Schools for enlisted specialists, for battery officers, and for field and staff officers, could be established for the review and test of their general training. By a carefully arranged schedule providing for short periods of intensive application, accompanied by proper periods for rest and recreation, a rather broad field of preparation could be covered in one week.

The second week of the mobilization period could be devoted to target practice. These practices should be grouped into two separate courses, a Gunnery Practice course for the development of proficiency in fire technique, and a Tactical course for the development of proficiency in fire tactics and for the test of the battle plans of the local defenses.

(1) *Gunnery Practice Course.*—This course conducted as a school of fire for all officers, could consist of a series of four firing problems. Each problem would involve the firing of a single battery, against a moving target. There could be one problem pertaining to mortars, one to primary guns, one to secondary guns, and one to antiaircraft guns. Each problem should consist of firing 6 to 12 salvos, and should be carefully prepared and outlined to the entire class before the practice opens. All available officers should be present at the firing battery to witness each practice. Provision could be made for the immediate display during the firing of each item of data employed, including reports of deviations of impacts, in order that the witnesses might observe and follow the computation of the firing data used for each salvo. All officers could be required to prepare the firing data computations at the time, and these solutions, made on suitable blank forms, should be submitted to the instructor at the close of the practice, for review. The firing should be executed by a designated organization, under the close supervision of its fire commander, and the personnel of all other organizations assigned to similar types of armament should be present, in order to gain familiarity with the conduct of the service firing. If desired, gun crews might be relieved by those from other organizations during the firings. The practice could be discontinued when the desired degree of precision of fire has been attained, this being indicated, for example, by two consecutive salvos "on target." Complete and accurate records could be maintained during the practice of all the data utilized in the firings, and a thorough analysis of the practice could be made immediately at the close thereof. The results of this analysis could be presented and discussed at a conference of all officers, held as soon as practicable after the close of each practice.

(2) *Tactical Course.*—Following the close of the gunnery practice course, a war condition period, lasting about 48 or 72 hours, could be inaugurated. This period could be devoted to the solution of a carefully prepared tactical problem, or series of problems, based upon the general defense plans for the given locality. Prior to the opening of this period all the necessary targets and towing vessels should be despatched to some suitable place outside the defense area, there to await until a designated time when they should then approach the given harbor in a stipulated formation and by a certain definite route, all in accordance with secret orders of the coast artillery district commander. With the opening of the war condition period, the naval patrol service and the army air forces could place the defense area and the seaward approaches thereto under constant surveillance, instituting the reconnaissance service

contemplated in the general defense plans. All batteries, stations, searchlights and other elements of the harbor defenses could be completely manned, relief details being made available to insure continuous effectiveness. The entire command should be placed, and maintained throughout, upon a complete status of "immediate readiness for action." If practicable, the services of other naval vessels might be obtained, to represent enemy vessels of similar classes, and these should accompany the targets in the approach to the defense area. These vessels would prove of valuable assistance for patroling the approaches of the firing area during the battle practice. The reconnoitering elements of naval patrol service and of the army air forces would report the approach of the targets, giving location, speed, direction of movement, formation, etc., and upon receipt of this information the batteries would prepare for action. The fire action would be opened as the targets entered the firing areas, and it should be conducted in conformity with the prepared battle plans adopted to meet that particular phase of the general defense. Each battery could be authorized sufficient ammunition for six salvos against each target to be taken under fire. By introducing the use of relief crews during prolonged phases of the battle practice, the maximum number of personnel could receive training. The entire fire action of the command could be conducted under battle conditions, and by the careful preparation of plans and with close attention to the details of the operation, a battle practice could be arranged and conducted which would afford the training necessary for the development of the battle efficiency of the entire command. Suitable provision should be made for the identification and observation of the fire of the various participating batteries, and for maintaining complete records of all data used by each in the practice, together with a diary of messages and orders received and transmitted and the exact time thereof. These combined records would constitute the basis for a thorough analysis of the entire battle practice, and this analysis could be made the subject for a conference or critique, participated in by all officers as soon as practicable after the close of the practice. A later study of the details of this battle practice and the records thereof would afford the opportunity for devising means to overcome the demonstrated defects and deficiencies of the general defense plan. This study could be made under the supervision of the coast artillery district commander, at any convenient time and place after the close of the mobilization period and the return of the personnel to their proper stations.

A system of coordinated training along the lines proposed in this paper is believed to be practicable, for the personnel necessary

to constitute the battle team are now available, and only await co-ordination to bring them together. The ammunition required for the proposed training is not in excess of the total quantity now supplied to the separate organizations, and the transportation and all other necessary facilities are now on hand and require only judicious and economical distribution and utilization.

It is believed that some system along the general lines indicated above would soon succeed in developing the entire coast artillery personnel (Regular Army, National Guard and Organized Reserves) that are located in each corps area, into a highly efficient battle team ready and available for immediate service in case of emergency at any of the harbor commands within the given corps area.

It is the duty of every man and woman to study deeply this question of national security, and learn how the process by which it is to be achieved results in a stronger and more reliable body of men and women. The future depends upon the development of every phase of individual character, and every element of national safety. There is but one voice that can determine the course to be pursued; one voice that can decide whether we shall follow the counsel of the fathers and the lessons of our own experience; one voice that can give direction to wise policies; and that is the voice of the people.—*General John J. Pershing.*

Antiaircraft Defense

By MAJOR J. C. HAW, C. A. C.

EDITOR'S NOTE: *This sketch is a highly condensed and entirely non-technical presentation of antiaircraft problems, materiel, organization, tactics, and accomplishments. While it is hoped that such a sketch will be of some interest to officers who cannot keep in close touch with this work, the chief object in compiling it has been to provide material for those who are called upon to present the subject in brief and simple form to R. O. T. C. students, civilians, and others who are more or less unacquainted with this phase of the Coast Artillery Corps' activities.*

THE term "Antiaircraft Defense" comprehends all defensive measures against aerial attack. It is evident that aviation itself is infinitely the most efficient and important single component of this defense, for our pursuit planes can seek out the enemy and attack him in his own element—the air—on equal terms. However, the work of the Air Service must be supplemented by purely ground formations. In the Civil War, the Cavalry of both sides made frequent raids in the enemy's rear; in the World War, with the German Navy completely bottled up, we saw his submarines in constant operation, while on the surface raider after raider went to sea and terrorized the Allied Merchant Marine. As on land and sea, so in the air; no matter how numerous our planes or how efficient our aviators, it is impossible to prevent a bold enemy from carrying out successful expeditions over our territory. The delay in gathering a sufficient concentration to meet air attacks in force may enable the enemy to reach his objective.

Further, the airplane is an offensive weapon, whose mission it is to seek out and destroy the enemy in his territory. If the strength of the Air Service is frittered away by scattering a great proportion of its units here and there for defense, we give up all hope of taking the initiative in the air. However, it is necessary to assign a relatively small number of pursuit planes to defensive work. These craft conduct constant patrols, and they fight in the same manner as other pursuit aviation.

To defend troops, small isolated positions of importance and large cities, ground defense elements are necessary. Only small areas should be forced to depend entirely on such elements, and for all large areas, pursuit aviation and ground defense should be combined.

The protective components are divided into two classes—active and passive. The passive elements are: kites and barrage balloons, camouflage, searchlights, and the information service.

Large kites may carry metallic cables. Barrage balloons are small affairs especially designed for forming a barrier of balloons. In the defense of London, nets were used, three adjacent balloons being joined by wire cable from which hung wires 350 yards long, with a sandbag at the end of each. The balloons were about five hundred yards apart. Perhaps a more efficient method is to place the balloons closer together and rely solely upon the retaining cables. If two balloons are used together, one above the other, an altitude of 11,500 feet may be attained. As an aviator cannot see the wires, he will not attempt to fly through the balloon barrage, but must alter his course to right or left or climb above it. The effect is to diminish the accuracy of bombing. Balloon barrages are useful for small areas only.

Camouflage is now tremendously important. At the front, every position must be concealed from enemy aviators. Otherwise it is subject to accurate artillery fire as well as bombing and aerial machine gun attack; while the enemy's general plans of action are much more likely to be successful if he has full knowledge of our dispositions.

In other cases, positions to be camouflaged are of two classes; namely, landmarks and objectives. The aviator can fly by compass; but on long journeys he is liable to need a reference point here and there to keep an accurate course, and in all cases he must have a distinguishing landmark at the point to be bombed.

Smoke may be used to camouflage small areas. If several patches of smoke be generated simultaneously, the flyer does not know which one hides the point he wishes to see.

Flimsy scenery may be erected, in exact imitation of structures located elsewhere.

Suppression of light is a most obvious measure of defense. Even at night, a large city cannot be hidden; but if no lights are visible, then the aviator cannot see it until he is almost upon it and must depend upon compass and landmarks to reach it. When Paris was fully illuminated, aviators at Villers-Cotteret could distinguish the glow, although the distance was approximately seventy-five kilometers. The lights in railway yards are very conspicuous from overhead, unless carefully shielded, while the glare from the opened door of a locomotive firebox is the aviator's best indication of a railway line. In Paris, patrols were constantly alert to enforce darkness, and necessary lights were made blue.

Sometimes "luminous camouflage" is used. High power lights with reflectors are scattered about over the area containing the point to be hidden, which is rendered invisible by the upward glare. This is obviously a very expensive measure.

Also lights may be dispopsed at some suitable point in a conformation that copies exactly some village or area with which the enemy is familiar, so that he is deceived as to his true position.

The British did a bit of camouflage that was almost a classic. To quote the report of an American officer on this British dump which was located near the front:

> Along the best line of approach, and at the usual distance from the area actually to be defended, were placed three batteries of artillery and three triangulated lights. These guns and lights were poorly camouflaged, so that when a high flying plane came over to photograph the dump they would show in the pictures, and at the same time it would appear that the British did not want them to show. Thus the enemy knew the relation of these guns and lights to the location of the dump. However, about a mile in advance, along the same line of approach, was the exact duplicate of the same layout with the exception that this installation was perfectly camouflaged. The result was that when an enemy plane came over at night and these latter batteries and lights opened on him, he knew from study of the photo that very soon he must drop his bombs to hit the dump. This he always did and the bombs therefore hit in advance of the dump. Then before daylight the British would go out and fill in the bomb holes and dig holes with the same relation to the inner defense that the actual bomb holes had to the outer defense. It was in January, 1918, that I saw this defense and it had operated successfully through the entire war until that date without the ruse being discovered.

Searchlights are used to discover the enemy at night and keep him in view of our guns or planes. They must be portable so that they can be placed wherever necessary.

The standard type in our Army is the Cadillac unit. When the light is in operation, the engine of the truck operates a generator mounted on the truck, which in turn furnishes power to the light. The light itself is of the open, or dishpan, type, sixty inches in diameter. It is mounted on a very light carriage with Ford wheels, pushed by hand; a cable six hundred feet long is provided for conveying the current from generator to light. When a move is to be made the light is run up on the track, which thus carries the entire unit. There is also a 30-inch light that can be placed in trees, towers and similar points of vantage.

In addition to revealing the plane to our own forces, searchlights are very confusing to the enemy pilot, for when the beam is upon him he can see nothing of the ground or of other aircraft.

Evidently, it would be almost impossible for a searchlight to discover a plane by searching at random, so listening apparatus is

provided to determine the direction of a plane by the sound of its engine. The problem of following the exact course of a target by sound is no easy one, for by the time the noise reaches the listener, the direction from which it appears to come is no longer the true direction to the target. One reason for this is that the plane moves some distance while the sound wave is travelling to the listener; wind and other factors add to the difficulties encountered.

The underlying principle of practially all listening apparatus is the detection of difference in phase of sound waves, the same principle that enables men and animals to determine the direction of a sound. Sometimes there are two receivers mounted on opposite ends of a rod that turns about a pivot; tubes lead from each receiver to the listener's ears. There are also single receiver types of parabolical or spherical shape. In either case, the receiver collects and concentrates the sound; and the direction is read off from an oriented "azimuth scale" (somewhat similar to the horizontal limb of a transit). This direction is then set off on a similar scale on the searchlight, and the target quickly located. Other types of apparatus are more complicated but subject to various defects. The most accurate device is said to be the Perrin Telesitemeter, with a mean error of only 0.13 of a degree.

Now for the active elements of the antiaircraft defense. The most important—pursuit aviation—has been mentioned already. Machine guns and antiaircraft artillery complete the list.

Antiaircraft machine guns are used to prevent low-flying planes from bombing and machine-gunning our positions. They are employed in the defense of roads, trenches, strong points, artillery emplacements, antiaircraft guns and searchlights, and so on. The most promising machine gun for antiaircraft purposes seems to be the water-cooled Browning .50-caliber, firing tracer or explosive bullets at the rate of 500 aimed shots per minute. Its horizontal range is five miles; vertical range, 8,000 to 12,000 feet.

There has just been developed another machine gun of 1.4 inches caliber, firing explosive shell at the rate of 100 to 120 shots per minute, with a vertical range of 14,000 feet. These shells burst on impact with the lightest fabric.

As the targets fly low and at great speed, appear unexpectedly, and are visible for very short periods of time, elaborate sighting is impossible, and the only feasible way to get hits seems to be by using tracer bullets so that their trajectory is visible.

A more complicated matter is that of antiarcraft artillery. This class of fire involves the greatest problems that have yet confronted the ballistician, the ordnance designer, and the artillery-

man. The target, whose vulnerable parts often occupy less than two cubic yards, moves at a speed of 80 to 200 miles per hour in three dimensions, and can change speed and direction with startling rapidity. If the plane should travel at 180 miles per hour and it should take the projectile 20 seconds to reach it, the gun would have to be pointed *one mile* ahead of the target even if our methods were absolutely perfect.

It is necessary to use high explosive shell or shrapnel, as these burst in the air, endangering everything within a radius of approximately fifteen yards. Their use entails fuse complications (mentioned later) but these are outweighed by the gain in danger space.

The latest American gun (still in the experimental stage) is 4.7 inches in caliber, with a muzzle velocity of 2600 feet per second, firing a 45-pound projectile to a vertical range of almost seven miles. With all-round fire, elevation from minus 5° to plus 80°, automatic breech opener, and pneumatic loading device, it is easily aimed and can be fired very rapidly indeed. A 3-inch gun of similar model is also being tried out. These guns are either self-propelled or towed by trucks or tractors, make fast time on good roads, and can travel across country.

The chief ammunition difficulty has been in the fuse question. In order to make the projectile burst at the exact instant desired, a very accurate time fuse is a necessity. The extreme changes of air pressure in antiaircraft fire render powder-train fuses unreliable. One alternative is clockwork. Imagine accurate clockwork that can withstand the shock of discharge and the tremendous velocity of rotation of the projectile! Such a fuse has been developed, however, and gives promise of considerable accuracy. A fuse actuated by the rotation of the projectile has also been proposed.

Several improved fuse setters have appeared of late, whose object is to set the fuse on the very latest data, including an allowance or lead for the time used up in setting the fuse, loading, and firing. These setters work automatically, eliminating the errors caused by waiting for an operator to receive data and set it on the fuse-setter. Some of them work by electricity.

However, the most intricate and perplexing difficulties are encountered in the realm of fire control—that is, the determination of the data to be set upon the guns in order to hit the target.

All fire at moving targets is a matter of prediction. The exact positions of the target at two or more given instants are determined; upon this information it is predicted that the target will

arrive at a certain point at a certain instant in the future, and the shot is fired at this imaginary point. The shorter the time occupied by the personnel in getting this data and firing and by the projectile in reaching its destination, the closer the predicted point to the last known point, and hence the greater chance that the target will actually reach the predicted point at the expected instant, instead of changing direction, altitude, or speed. The time element becomes of incalculable importance when the target travels from one and one-third to three and one-third miles per minute.

To determine the position of a target at any instant, it is necessary to know: (1) its direction from the battery, (2) its range (straight line from battery to target), (3) its altitude. In our service, these data are generally determined by using instruments at both ends of a measured base line. Obviously, it would be more satisfactory to eliminate one station and make all the measurements from a single point near the guns. There are several instruments for doing this, and when they are sufficiently developed, a single station scheme will undoubtedly replace the present system.

The next step is the prediction of the future position of the target; and finally, this data must be translated into terms of elevation, direction (or sight setting) and fuse setting for the gunners. (The gun may be aimed by the use of a telescopic sight or laid by an oriented scale and a quadrant, in which case no sight is used.) All these very involved processes must be performed in a few seconds—the fewer the better. Hence a great advantage will be secured if a single machine can be made to perform these computations, which must be done almost instantaneously and as a continuous operation, so that there is a constant flow of data to keep up with the movements of the target. Several such machines have been invented. Some of them are purely mechanical, others depend upon the use of electricity, but none have given full satisfaction. The ultimate aim is a single machine, operated by one man, that will measure the position of the target, predict its future position, and compute the firing data to set on the guns. Such a development will increase tremendously the accuracy of fire.

The next consideration is the organization of antiaircraft units. In our Army, the basic group is the regiment, which consists of one artillery battalion and one machine-gun battalion. The artillery battalion is composed of three gun batteries of four guns each (total, 12 cannon) and one searchlight battery of twelve lights. The antiaircraft machine-gun battalion consists of four companies of twelve machine guns apiece, a total of forty-eight machine guns. There are 63 officers, 1 warrant officer and 1,450

men in an Antiaircraft Regiment. To each Army Corps (about 83,850 men) is assigned one regiment of antiaircraft artillery. To each Army (composed of two or more Corps) is assigned one brigade of three regiments of antiaircraft artillery, in addition to the regiment with each Corps.

Before considering the manner in which antiaircraft elements are disposed for defense, it is necessary to understand the mission of the defense. This may be stated as follows:

(a) To prevent enemy aircraft flying at such heights over our positions that they can observe and photograph, direct artillery fire, attack our balloons, drop bombs with accuracy or attack troops with machine guns.

(b) To prevent enemy aircraft dropping bombs on vital points behind our lines.

(c) To compel enemy aircraft flying in formation to lose their formation and thus render them more vulnerable to attack by our own aeroplanes.

Then we should know the kind of aircraft that we will be called upon to oppose. This information is contained in the following table:

Kind of Plane	*Approximate Altitude—feet*	*Speed—Miles Per Hour*	*Remarks*
Pursuit	Very High	100—200	Purely fighters.
Reconnaissance	16,000	80—120	Photographic and general observation.
Day bombers	16,000	80—100	Bombing close to their own base.
Night bombers	7,500	80—100	Long distance bombing.
Infantry or attack	200—3,000		Machine-gun attack of ground forces.
Dirigibles	Very High		Long distance bombing, usually by night.

There are two cases of defense to be considered; namely, front lines and back areas.

Front-line defense is based on the antiaircarft regiment. First, there is the gun area. About 1,200 to 2,000 yards in rear of our front lines are placed two rows of antiaircraft machine guns, followed by two lines of antiaircraft artillery from 2,000 to 5,000 yards in rear of the infantry's first line, each battery being accompanied by one searchlight. In rear of the gun area comes the airplane area, extending about 25,000 yards to the rear of the first line,

provided with antiaircraft searchlights and patrolled and defended by our pursuit planes. Still further to the rear each Army is charged with the defense of all railheads, depots, parks, dumps and headquarters in its own area.

The civilian is naturally more interested in the defense of rear areas, such as large cities. For such places, antiaircraft artillery is disposed along probable lines of approach, and also in one or more complete rings around the area. The outer ring may be 25,000

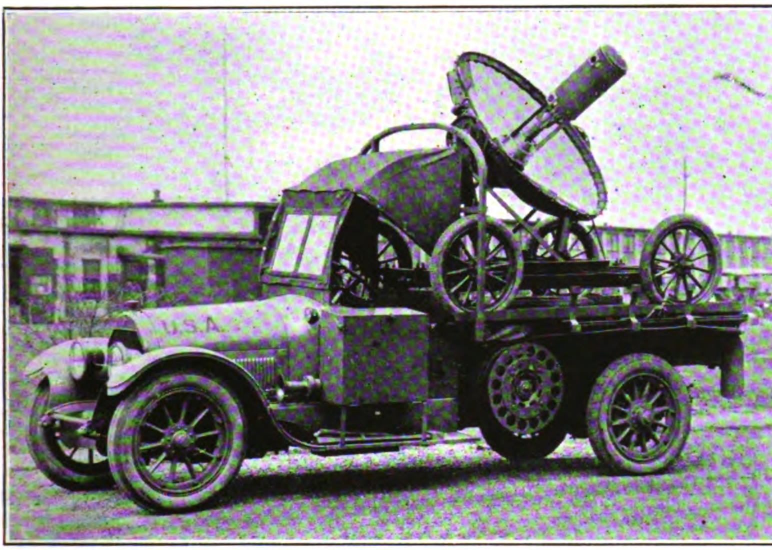

FIG. 1. CADILLAC SEARCHLIGHT UNIT

yards from a great city, while other batteries may be disposed within the city itself. Antiaircraft machine guns are placed at bridges, important factories, etc. Searchlights and listening posts play an important part. Smoke screens and painted scenery may be used. Pursuit squadrons are located at suitable places.

All of these elements are linked up by an intricate network of wireless, telegraph, and telephone communications, which also connect with observation and listening posts placed at intervals all the way to the theater of operations. In future, this system may be supplemented by radio from our own planes. Thus, when an enemy plane crosses our lines, the headquarters in rear are kept informed of its progress. At the antiaircraft defense headquarters in Paris, for example, everything centered in the office of a general whose sole task was the command of the antiaircraft defense. A great map showed the location of every battery and airdrome, and on this was traced the course of the invading planes. A light flashed

Fig. 2. Antiaircraft Guns in Action

on for each unit as it went into action. Often the attack was defeated at such a distance from the city that it was not necessary to sound the alarms which sent citizens scurrying into cellars and subways.

So much for organization and tactics. As the difficulties of antiaircraft artillery and machine-gun fire have been emphasized, let us pause for a moment to examine into the actual accomplishments of these two elements. Since the vulnerable part of an airplane consists of less than two cubic yards, relatively few direct hits can be expected. However, antiaircraft fire, if uncomfortably close to the pilot, forces him to change his course or to fly considerably higher, and he is unable to photograph, observe, bomb or machine-gun ground formations with full efficiency. Moreover, if he changes course or altitude, he is liable to become separated from the other planes in his unit, and is then easy prey for our pursuit planes.

Many pursuit pilots forget that their own experience forms no fair criterion, as the pursuit plane is the hardest to hit and moreover can do the least damage to anything on the ground; while the primary mission of antiaircraft artillery and machine guns is to protect *ground* formations.

Our battalions in France made a splendid record, shooting down fifty-nine planes; forty-one of these were shot down by two antiaircraft machine-gun battalions (total ninety-six guns) at an expenditure of 5,491 shots per plane brought down. The value of special training is shown by the fact that during the same period there were about 1,500 other guns of the same type along the front; these, not being manned by specially trained personnel, brought down only two planes, as far as known. Our antiaircraft artillery brought down eighteen planes at an expenditure of 1,050 shots per plane.*

It is encouraging to compare these figures with the statistics of deaths (not wounds) caused by artillery and rifle fire in terrestial combat. In the World War, it took 395 Allied shells to kill one German. In the Franco-Prussian War, it required 1,100 bullets to kill a man.

But the wartime records of antiaircraft fire have since been surpassed in the most astounding manner. In firings at Fort Monroe, where the target was a sleeve 20 feet long and tapering from 4 feet to 2½ feet in diameter, towed by an aeroplane, the antiaircraft machine gunners last year made seventeen hits in 9,000 shots, or one hit for every 530 shots. On a similar target, 6 feet shorter, the artillery made two hits out of 118 shots, or one hit for

*These statistics were furnished the author by the COAST ARTILLERY JOURNAL, and were compiled from the records of the Chief of the Antiaircraft Service of the A. E. F.

every 59 shots. Of course, the conditions were more favorable than would be the case in war; but even so, the record is truly remarkable. Great things may be expected when an improved fire control system is developed.

At the same post, searchlights, working on information provided by a paraboloid listening apparatus, were able to pick up Navy Planes and Army Martin bombers in less than twenty seconds after the lights began searching.

Finally, to show the efficiency of a well-rounded defensive system in actual war, we may cite the statistics covering all night bombing raids on Paris in the year 1918. In this year, no less than 483 German planes attacked the French capital; thirteen of these were shot down, and *only thirty-seven* flew above the city itself, dropping a total of only 11,680 kilograms of bombs. Yet the Germans announced that 22,000 kilograms fell on Paris in a single raid, the night of September 15-16.*

From the moment that he crossed his own lines, a German pilot was harassed by searchlights, aircraft and artillery fire, until, discouraged, he dropped out of his formation, released his bombs on the nearest village, and sped for home.

If the Coast Artillery Corps, operating antiaircraft artillery, listening apparatus, searchlights, machine guns, and the information service, and assisted by the Air Service in patrol and pursuit work, can give as good protection to American cities as the French gave to Paris, we shall have reason to be proud; and if Congress will only give the Army men and money in sufficient quantities, we can do it.

***L'Illustration*, March 22, 1919.

For nowhere in our history can anybody find, for I have looked, a soldier, professional or National Guard, who took any part whatever in agitating for a war.—*Newton D. Baker.*

The Influence of Air Power on Coast Defense

By Major J. T. McNarney, A. S.

Editor's Note: *Many* Journal *readers will consider that in the following interesting article the author attributes exaggerated powers to airplanes and aerial components. They may also feel that some of his statements are not yet proven, or are at least disputable. However, the* Journal *presents the article as representing the ideas of at least one member of the Air Service and will welcome further discussion of the subject.*

THE full development of air power cannot as yet be foreseen, but, considering it only in its present state of development, it may be stated that air power will exert a considerable influence upon both the strategy and tactics involved in naval, military, or combined operations. Specifically, it may be stated that the Air Service, as now organized, constitutes an important element in the positive system of coast defense, due not only to its ability to obtain and transmit information of the enemy but also to its ability to engage by fire action the hostile aerial, naval, and military forces.

The aerial forces available for operations in the event of hostilities may be classified as:

(1) The Observation Service, including both heavier- and lighter-than-air units.

(2) Combat Aviation, including pursuit, bombardment and attack units.

Observation

The role of the Observation Service in any type of operation may be briefly stated as follows:

(1) To furnish information as to the location, size, composition, disposition, and activity of the hostile forces;

(2) To increase the value of artillery fire by accurate observation for fire control.

Experience in the World War has amply demonstrated that single airplanes, manned by determined personnel, can execute reconnaissance missions even in the face of hostile superiority in the air and of heavy antiaircraft concentrations. The preliminary practice incident to, and the actual operations involved in the destruction of, the German War vessels placed off the Virginia Capes in positions unknown to the aerial forces participating, and well beyond the sight

of land, have proven the ability of aircraft, operating at long distances from shore, accurately to locate and report upon the size, nature, and activity of shipping operating off the coast. Joint Air Service and Coast Artillery exercises particularly at Fort Monroe and the defenses of Manila have demonstrated the possibility of conducting accurate fire at long ranges by the use of aerial observation. It may be stated, therefore, that any force possessing aerial observation has at hand a means by which accurate information of the enemy's strength, location and disposition may be rapidly obtained at will. Under favorable conditions it will also have available a means of determining enemy activities over an extended period of time and of obtaining observation for fire control on objectives which for any reason cannot be seen by ground observers. However, whenever the nature of the information desired is such that the observer must remain in observation for any considerable period of time, the success of the mission depends to a large extent upon the enemy reaction, which is in turn almost wholly dependent upon the relative activity of the opposing pursuit forces.

Bombardment

Bombardment is that branch of the Air Force whose primary function is to destroy hostile military or naval objectives by means of projectiles dropped from aircraft.

By a series of notable achievements, including several transcontinental flights, the Alaskan Flight, the World Flight, and the recent night flight of a squadron of bombardment airplanes from Langley Field to New York, the Army Air Service has amply demonstrated the ability of the present day airplane to cover long distances and arrive at the objective under unfavorable conditions of weather and visibility, both by day and by night. Further, the ability of bombardment aircraft actually to deliver attacks against objectives covered by extensive protective agencies, such as listening posts, searchlight installations, balloon barrages, and antiaircraft artillery, has been demonstrated by the successful German attacks on Paris and London, by the British day raids on Cologne and other Rhine cities, and by the flight of Italian aviators over Vienna. The numerous experiments carried out by army and navy aircraft against naval vessels have proven that naval or commercial vessels, regardless of type, can remain within the radius of action of aerial bombardment only at the risk of complete loss or serious damage. The damage inflicted by aerial bombardment during the World War cannot be taken as a criterion as to what may be expected at present, due to the fact that the great majority of bombs used on war raids

did not exceed fifty-two pounds in weight and seldom exceeded one hundred pounds. At present, with bombs ranging from twenty-five pounds to four thousand pounds, it is difficult to imagine any exposed objective which can successfully withstand aerial bombardment. The accuracy of bombing to be expected against any type of target cannot be arbitrarily set forth, depending as it does upon training, morale, enemy air and ground reaction, weather and visibility. However, with the recent and continual improvement in methods of bomb release, in bomb sights and in mechanical aids to flying, it is only reasonable to expect a continual and apparent increase in accuracy over that already demonstrated. Considering the above, it may be stated that a force having bombardment aircraft available and with operating bases within from 250 to 300 miles of the proposed objective will possess a means to inflict serious damage upon any exposed physical establishment either by night or by day. Day raids, however, will be influenced to a considerable extent by the hostile pursuit activity.

Attack

Attack is that branch of the Air Force whose primary function is to attack military objectives on the ground by means of light bombs and machine-gun fire.

Actual experience in the use of attack under war conditions is limited to the exceptional use of observation and pursuit units for this purpose during the latter part of 1918 and to the British operations in Mesopotamia. It can, however, be stated in the light of actual experience and the results obtained therefrom, that low flying airplanes carrying light bombs and machine guns have demonstrated their ability to silence or interfere seriously with the operation of hostile machine guns and artillery, to delay seriously the movement of formed bodies of troops or trains, to inflict casualties upon and reduce morale of troops in bivouac or cantonment, and to inflict serious damage upon aircraft on the airdrome, both by attacking operating personnel and by actual destruction accomplished.

It is apparent, therefore, that a force having aerial attack available (or when unavailable if existing conditions permit the use of observation or pursuit units for this purpose) will possess a means to delay materially the movements of, and to inflict casualties upon, supports and reserves, to delay the movement of supplies, to support any type of attack by counter-battery work against machine-gun and artillery emplacements, and indirectly to hinder enemy aerial operations.

Pursuit

Pursuit is that branch of the Air Force whose primary function is to seek out and destroy hostile aircraft, thereby gaining and maintaining control of the air.

Control of the air in its broadest sense is obtained only when all types of friendly aircraft are able to function without interference by hostile aerial action, and when, at the same time, the enemy aerial forces are prevented from attaining their several objectives. Complete control of the air is seldom attainable. However, control of the air in a more limited sense, or in other words superiority in the air, may be said to exist when the friendly aircraft are enabled to complete successfully a greater proportion of their missions than the enemy. Control of the air depends in a large measure upon the operation of pursuit aircraft. With the opposing forces approximately equal the force possessing the initiative may, by concentration of all or a large part of the pursuit forces available, secure superiority in the air in a particular locality for a limited period of time. Such superiority is possible even to a considerably inferior force, but only at the cost of hostile control of the air upon the expiration of the period of patrol. If, however, operations are continued over a considerable period of time, the force possessing superior numbers or more adequate replacements will eventually secure and maintain superiority by aerial combat. In addition to aerial combat, superiority may be attained by direct action with bombardment and attack against the hostile airdromes or carriers; but as long as any hostile pursuit capable of taking the air exists in the zone of activity the maintenance of superiority or control of the air rests with the pursuit. The value of pursuit in any operation may then be said to vary according to the measure in which it permits the operation of friendly forces, both ground and aerial, without interference from hostile air activities. It may be stated, then, that a commander having available a pursuit force approximately equal to that of the enemy may obtain for a limited period of time superiority in the air at any point desired, such superiority conferring comparative freedom of action upon his remaining aerial, naval and military forces.

The foregoing discussion having brought out in brief what may reasonably be expected of the several branches of an aerial force in any type of action, it is now proposed to set forth as concisely as possible the influence exerted by aerial participation in attacks against a coast line and the role of the aerial forces in the defense thereof.

The form or forms of attack adopted by a force operating against a coast are, of course, dependent upon the existing situation, the enemy forces to be overcome, the forces available, and the mission assigned. Of the several general forms of attack possible, the following,—namely, raids, direct attacks against harbor fortifications, and landing attacks in force, have been selected for discussion due to the paramount interest of the military forces therein. The support furnished any overseas operation by aerial participation therein must be measured by the ability of the invading air force to accomplish successfully the specific missions assigned. The actual missions assigned will depend upon the ultimate mission of the entire force, the number and type of aerial units available, and the existing or obtainable knowledge of the nature and location of the defenses to be overcome on land, on water, and in the air. The successful execution of such missions is dependent not only upon the nature and extent of the hostile aerial and ground reaction but also upon the ability to launch the required number of aircraft from floating bases or to obtain land bases protected from ground interference by military support or concealment. Such limitations constitute a severe handicap to successful operation, but, under ordinary weather conditions and especially if unopposed by a well-organized and balanced air force, they cannot be expected to prevent operations.

Raids

In general, raids may be classified as:

(1) Unsupported,

(2) Supported.

Raids of the first class are surprise attacks carried out by light enemy forces for the accomplishment of a minor mission. Supported raids are those in which the forces actually participating in the attack are escorted or assisted by considerable naval or aerial forces or by both in the attempt to carry out an important mission which will affect the entire campaign. Either class of raid may be effected by aircraft, surface vessel, or submarines either alone or in combination.

Unsupported raids, however, will rarely be undertaken by bombardment aircraft unless secure bases are available within their effective radius of endurance, as otherwise they must operate from carriers or tenders which are extremely vulnerable to attack by aircraft, destroyers or submarines and therefore require support. This type of raid, in general, will be restricted to light fast surface vessels or submarines which will depend for safety upon the avoidance of naval combat by speed or concealment. A consideration of the

influence of aerial operations on this type of attack may then be restricted to that caused by aerial observation. In accordance with the possibilities of aerial observation as previously outlined, and due to the fact that unsupported raids will in general be carried out against unprotected or poorly protected localities where little or no aerial opposition is to be expected, the commander of the raiding force will be enabled to obtain:

(1) Accurate information of the objective to be attacked, including the strength and location of existing fortifications, supporting naval forces if any, and the nature and location of shipping, harbor or other utilities which it is desired to destroy;

(2) Accurate information as to the enemy naval or aerial forces which might interrupt the mission or be concentrated against him;

(3) Accurate information as to the relative location of commercial shipping and its naval support if any;

(4) Observation of artillery fire at long ranges or while protected from view by a smoke screen or other obstruction.

The participation of aerial observation in unsupported raids may then be expected to result in:

(1) Increased knowledge as to the exact nature and location of the objective to be attacked, with a consequent increase in the effectiveness of the raid and in the damage inflicted;

(2) Increased knowledge of the strength and location of defenses to be overcome or avoided, with a consequent decrease in the possibility of resulting loss;

(3) And therefore a likely increase in the number of such raids against both commercial shipping and land objectives, especially when superiority on the sea is yet to be obtained.

Supported raids may be accomplished by aircraft, surface vessels or submarines, either singly or in combination. The aerial forces participating in such raids will usually consist of observation and bombardment units and may, in addition, include pursuit and attack units.

As far as the operation and resulting influence of observation is concerned it will differ little from that previously outlined in connection with unsupported raids and therefore requires no further discussion.

Prior to the advent of aerial bombardment, it was usually necessary, even when enjoying command of the sea, for an enemy force, contemplating a raid of any magnitude, to support his attacking vessels by superior squadrons of battleships. This resulted in the exposure of his capital vessels to loss from defending land arma-

ments, destroyers, submarines, and mines. Such raids would then be undertaken only after a serious consideration of the probable results to be obtained. However, with the advent of aerial bombardment the hostile commander will have available an arm of great destructive power which is capable of operating over long distances, thereby reducing to a considerable extent the liability of loss or serious damage to the supporting vessels.

Considering, then, the capabilities of bombardment aircraft as previously discussed, it may be stated that a force possessing aerial bombardment, in addition to surface and underwater craft, will have available a means to accomplish the following, all without undue risk to the armored battleship:

(1) The destruction of harbor utilities, naval bases, commercial shipping, and industrial plants of military value;

(2) The destruction of naval vessels protected by land armaments, refitting at naval bases or operating on the high seas;

(3) The obstruction of naval communications;

(4) By systematic and continued raids on harbor fortifications, such damage to the defenses, with the consequent reduction in the morale of the defenders, that penetration into, or complete reduction of, the harbor defenses by a direct naval attack is rendered feasible;

(5) The concealment of the true mission by feints at a considerable distance;

(6) The destruction of or rendering untenable airdromes occupied by defending aerial forces.

Raids by aerial bombardment may require the support of aerial forces unless executed under cover of darkness or against localities where the defenses against aircraft are non-existent. In a similar manner, raids undertaken by naval vessels may require protection against attack by hostile aircraft. Such support may and, in the case of raids which will influence the existing situation to any considerable extent, probably will consist of:

(1) Pursuit operations to maintain superiority in the air during the continuance of the raid, thereby preventing aerial attack on the raiding forces either by gunfire or by bombs;

(2) Attack operations against personnel to interfere with the operations of machine guns and artillery weapons;

(3) Attacks against hostile airdromes with light bombs and gun fire to prevent operation therefrom during the continuance of the raid.

In view of the foregoing, it may be stated that aerial participation in supported raids will in general result in:

(1) Increased knowledge of the objective to be attacked and the defenses to be overcome or avoided, thereby increasing the probability of success;

(2) Increased possibilities of inflicting serious damage upon the opposing naval forces regardless of their location, thereby directly aiding in the attaining and maintaining of control of the sea;

(3) Increased possibilities of inflicting serious damage upon military objectives, thereby directly influencing the action of the combined force especially in attacks against heavily fortified positions;

(4) Decreased possibility of damage of the attacking units by naval, military or aerial forces, thereby increasing the probability of success;

(5) Decreased possibility of damage to the supporting naval forces by naval or aerial operations;

(6) Rendering possible the execution of successful raids, either by day or by night, without counting too heavily upon the element of surprise;

(7) Requiring the defenders to maintain defenses along the entire coast line, thus dissipating their forces;

(8) A probable increase in the number of, and in the damage resulting from, attacks of this type.

Direct Attacks Against Harbor Fortifications

History is replete with instances demonstrating the difficulties, well nigh insurmountable, confronting a naval force attempting to penetrate within a well-defended harbor, either with or without the support of land forces. Such attacks, demanding the participation of capital ships, the loss of which may result in the failure to maintain sea communications thereby causing the failure of the entire campaign, are undertaken with caution and only where warranted by corresponding results. However, conditions may arise when, due to superior armament or new offensive means or methods, such attacks may be justified. Whether the contemplated attack is to be carried home by naval forces alone or by both land and naval forces, preliminary operations are necessary in order to enable the capital vessel to approach within range of the defending armament and to deliver the maximum effective fire against such armament with the greatest degree of safety to itself. Such operations must include a preliminary reconnaissance of the position to be attacked, followed by the removal of barriers to the approach, and finally the execution of such measures as may be possible to reduce the defensive power of the position in preparation for the final assault.

There can be little doubt but that in any operations undertaken by a modern power against a heavily fortified position, aerial operations of some nature may be expected throughout all phases of the attack. Further, it is altogether likely that such preliminary reconnaissance as may be necessary, as well as reconnaissance during the course of the combat, will be accomplished almost in its entirety by aerial observation. Considering then the possibilities inherent in that branch, it is only reasonable to assume that the attacking force will be able to obtain accurate and timely information as to:

(1) The composition, location, and strength of all emplaced armaments for harbor defense, as well as such naval elements as may be present, and the organization for landward defense;

(2) Fire control and searchlight installations, channels and channel markings, and the location and extent of mine fields;

(3) Location, strength and activities of supporting naval forces within striking distance;

(4) Location and type of airdromes occupied by supporting aerial forces;

(5) Location of bays, inlets or landing fields without organization for defense, which may be occupied for the purpose of dispatching bombardment aircraft;

(6) The nature and extent of damage inflicted upon the harbor defenses, utilities, naval or aerial supports during the preliminary operations prior to the assault.

Having determined by a preliminary reconnaissance the obstacles to be overcome, it is only to be expected that all means available to the attacking force will now be employed in order to reduce the effectiveness of the defenses, both prior to and during the assault. The presence of aerial bombardment makes available an arm capable of attaining such results without the necessity of unduly exposing the capital ships to loss or damage. The participation of aerial bombardment throughout the attack then is to be expected. This participation will be in the nature of supported raids as previously discussed. These raids will be directed against such objectives as are most dangerous to the execution of the assigned mission, which will be in general those elements of the defense most dangerous to the capital vessel.

From the foregoing discussion, the immense advantage accruing to an attacking force possessing aerial observation and bombardment over one not so equipped can easily be seen. However, in order to obtain this advantage in its fullest measure, it is necessary to support these forces by aircraft capable of neutralizing enemy defensive measures, both ground and aerial, directed against either the units

actually engaged in the attack or against the supporting units. It is in this role that pursuit and attack units fulfill their primary functions. In addition, these units may, if conditions warrant, participate in the attack against objectives not concerned in antiaircraft activities, such as personnel operating both primary and secondary armament, and supports and reserves attempting to prevent landing operations within the harbor or preparing to counter-attack the investing land forces. The influence of aerial operations on direct attacks against a heavily fortified position may then be summarized as follows:

(1) The commander of the attacking forces will be better able to make an accurate estimate of the situation both prior to and during the successive phases of the attack, thereby increasing the probability of success;

(2) Render possible the infliction of serious damage on coast defenses, exposed personnel, fire control installations and naval vessels on the high seas or protected by land armaments without endangering to any considerable extent the first line battleships;

(3) Produce a likely increase in the number of preliminary attacks and in the resulting damage upon the defenses;

(4) Render possible the placing of a well-directed fire of major caliber upon the defenders' position without undergoing the danger of directed fire in return;

(5) Decrease the probable damage to the fleet during the successive stages of the attack by direct action against the defending aircraft and airdromes;

(6) In general, to increase the probabilities of the success of this type of attack, thereby increasing the number of such attacks to be expected in the absence of an adequate aerial defensive organization, with the possibility that the deterring influence of harbor fortifications will be in a large measure dissipated.

Landing Attacks In Force

An army which is to maintain itself in an enemy country must, in addition to securing control of the sea, secure a harbor where existing or extemporized facilities will permit the unloading of artillery, transport, and other heavy war material. As such harbors will in general be heavily fortified, the invading forces will, unless such defenses have been reduced by a direct naval and aerial action, be restricted to beaches suitable for landing large forces and within striking distance of an available harbor. Attacks of this nature involve the debarkation of troops consisting largely of infantry, without

transportation and with little artillery, but supported by artillery fire of ships' guns and by combat aviation.

In this form of attack, as in any other, reconnaissance both prior to and during the action is certain, such reconnaissance being effected largely by means of aerial observation. The results to be expected therefrom may be stated as follows:

(1) Make available information concerning the nature and extent of beaches considered available due to their proximity to a military objective;

(2) Make available information of the defensive measures undertaken at such beaches, including intrenchments, wire entanglements, artillery and machine-gun locations, etc.;

(3) Give timely information as to the location and movement of beach supports and reserves;

(4) Make available information concerning road and railroad facilities and localities offering special opportunities for the delay of movement of personnel and supplies;

(5) Give timely information as to the location of supporting aerial forces;

(6) Give timely information as to the approach of naval units which might interrupt the operation;

(7) Increase the accuracy of naval fire in support of the attack by observation for fire control.

The successful issue of the operation depends in a large measure upon the ability of the invading forces to decrease by every means possible the time involved in landing a force sufficient to prevent dislodgement by such beach supports and reserves as may be concentrated by the defenders, until it is possible to land a sufficient force to assume the offensive. In accomplishing this object the invaders may be expected to:

(1) Take advantage of the element of surprise;

(2) Approach the beach selected as closely as possible before disembarking in small boats;

(3) Delay by every means possible the concentration of beach supports and reserves.

Further, due to vulnerability of the unarmored transports, the disadvantageous position and immobility of the troops being carried in small boats, and the difficulties involved in landing therefrom in the face of organized resistance, in order to insure success the attacking forces must:

(1) Insure the prevention of an effective attack on the transports either by aerial bombardment or artillery fire;

(2) Insure the prevention of an effective attack on the small boats by aerial attack units, by artillery or by machine-gun fire;

(3) Support the attack with an artillery preparation designed to destroy obstacles such as wire;

(4) By observed fire and aerial action destroy or prevent the operation of machine guns and both light and heavy artillery.

Consider then the possibilities inherent in the Air Force—pursuit, attack, and bombardment—to obtain these ends. Due to the ability of bombardment aircraft to cover long distances with great speed, it is possible to mislead the defenders as to the true intentions of the invaders by means of feints against other portions of the coast and still have the raiding forces available for participation in the main attack.

It is by use of the Air Force alone that the offensive may be carried to objectives beyond range of supporting naval artillery, and the early initiation of such measures may well become the determining factor in the success or failure of the engagement. Such offensive measures will include direct attacks against reserve cantonments and against supports, reserves or artillery on the march, measures to delay the arrival of such forces by destruction of bridges, blocking defiles, etc., and the attack of airdromes. The Air Force may in addition be called upon to render support at the scene of the actual engagement and, in this role, is capable of interfering seriously with the operation of machine guns and both light and heavy artillery, thereby not only affording support to the debarking troops but also rendering protection to the transports and naval vessels exposed to long-range artillery fire. Further, pursuit operations afford the only effective means to insure the results outlined above and to prevent attacks launched by aerial units against the small boats, transports, airplane carriers and tenders, or the supporting naval forces.

An analysis of the above possibilities of aerial participation in a landing attack will clearly show:

(1) That every essential required to insure success can be attained, or at least appreciably furthered, by such participation;

(2) That the probability of the success of such attacks is greatly increased;

(3) That the probability of serious losses to any element of the attacking forces is materially decreased;

(4) That the present system of positive coast defense will in general be unable to prevent landing operations by an invader provided with an efficient air force unless supported in turn by well-organized combat aviation.

In spite of the handicap imposed by the very nature of an overseas operation, it is evident that air power properly used constitutes an invaluable aid which may, and if unopposed will, in most cases furnish that superiority in offensive power necessary to insure success. It is imperative, therefore, that any system of coast defense include measures to counter this power effectively.

Due to the increased knowledge and offensive power available to overseas invaders through aerial operations, it is more than ever necessary for the defender to obtain accurate and timely information as to the location, size, composition, and activities of the invading forces in order that the necessary defensive measures may be undertaken without undue dispersion of forces or loss of time. This requirement can be met by the employment of aerial observation as follows.

A line of distant reconnaissance should be established which by means of rigid dirigibles and airplanes operating from naval scouts will insure determination of the location of the approaching enemy forces while still at great distance from the coast. In addition, observation squadrons should be stationed at strategic points along the coast, usually in proximity to harbor defenses. These units will initiate a system of coast patrol designed to furnish accurate and timely information of the approaching hostile forces. Opposite beaches feasible for enemy landings and opposite harbor defenses, such patrols, operating up to a hundred miles off shore, will be practically continuous. They will be in continuous communication by radio with shore stations and capable of communicating with vessels at sea. Such patrols, supplemented by captive balloon observation, will, under any weather conditions except long-continued fog, locate, maintain surveillance over, and make accurate report upon the location, size, composition, and direction of motion of the approaching forces. In addition these squadrons will furnish aircraft to cooperate directly with coast defense artillery. These aircraft will furnish shore batteries with the information necessary in order to open and maintain a well-directed and effective fire on enemy objectives when long range or intervening obstacles, such as smoke screens, make shore observation of fire impractical.

In general any type of attack against a coast may be met by any one or by a combination of the following methods:

(1) By offensive action preventing the hostile forces from approaching within striking distance of the coast;

(2) By destroying or rendering untenable the position of the forces actually engaged in the attack;

(3) By destroying or rendering untenable the position of the naval forces supporting the attack.

The first method will, in general, be undertaken by the fleet assisted by aerial forces and will not be discussed further. The second and third methods will be undertaken by the combined operation of naval, military and aerial forces. However, since the system of coast defense must be based upon the assumption that the battle fleet will not participate in coast defense as such, and that the defense must be complete even if control of the sea is lost, the participation of naval forces must not be relied upon. Of the remaining elements, the air force is the only one capable of maintaining an effective offensive or offensive-defensive against the invading forces, as follows:

(1) Against airplane carriers and their naval supports;

(2) Against transports, battleships and other craft prior to their advance to a position within range of shore batteries;

(3) Against enemy aircraft, once their attack has been initiated;

(4) Against enemy aircraft observing fire for naval artillery;

(5) Against transports and their supports at localities where, due to surprise or lack of facilities, long-range artillery is non-existent.

Further, it is of extreme value in the attack against troops debarking in small boats and in the disorganization and delay of troops already landed. The role of the Air Force in coast defense may then be summarized as follows: Pursuit, attack and bombardment groups should be concentrated at strategic centers for aggressive operations to—

(1) Destroy or inflict the maximum possible damage upon the hostile aerial and naval forces before they come within range of the existing artillery weapons;

(2) Render untenable any position taken up by hostile aerial and naval forces for the purpose of bombarding or making an attack in force against any shore objective,—this action being coordinated with such coast defense artillery as may be available at the point of attack;

(3) Destroy or render untenable the position of transports or small boats carrying landing parties,—this action being coordinated with such coast defense artillery as may be available at the point of attack;

(4) Cooperate with beach supports, reserves and the mobile forces in attacks against troops already landed;

(5) Destroy hostile aerial forces engaged in the attack of, or in support of, an attack against land defenses,—this action being coordinated with such antiaircraft artillery as may be available at the point of attack.

It may thus be seen that the Air Force, as well as the other branches and arms of the military and naval forces, has a distinctive mission, and, while in the present state of development it may not constitute a self-contained and positive system of coast defense, it is an arm essential to the defense of a coast line and must in a large measure be depended upon to counteract the influence of aerial participation in the attack.

We all hope and pray that it may not be necessary for our sons or for any future generations of Americans to defend by force of arms this nation's principles, ideals and rights. But who can say that our wish will come true or our prayers be answered? Who can say that history will not repeat itself—that the future will be unlike the past,—that what always has been will never be again,—that men and nations have cast aside their selfish feelings, desires and passions? As President Coolidge said a few weeks ago: "Though ultimately I believe that peace will prevail, I have too much knowledge of the history of mankind, and too much experience with the traits of human nature to dare assert that we shall never again be engaged in war."
—Honorable Dwight F. Davis, Acting Sec'y of War.

The Battles of Ludendorff On the Russian Front*

By GENERAL HUBERT CAMON, *French Army*

Translated by Captain E. M. Benitez, C. A. C., and reprinted by special arrangement with Berger-Levrault, publishers of *Revue Militaire Generale*

THE BATTLE OF LODZ

NOVEMBER, 1914

THE so called battle of Lodz was nothing but a series of chaotic combats, wherein Ludendorff put into execution Napoleon's maneuvers against the rear of the Russian forces, which towards the latter part of October, 1915, were deployed in a circle of 150 kilometers at the west of Warsaw.

These maneuvers have already been analyzed, but in order to understand the combats to better advantage, we will review them briefly.

It will be remembered that after the offensive of the IX German Army against Warsaw, which eventually developed into a Russian retreat, the Grand Duke Nicholas was advancing at the head of the 2d, 5th, 4th and 9th Armies to invade Silesia.† The Russians made a halt in order to repair their supply railways, and Ludendorff not being able to stop the Grand Duke by opposition against the latter's front, conceived the idea of taking advantage of the Russian halt to transport his IX Army to Thorn, reinforce it there and then direct it across the Russian supply railways at Warsaw thus cutting off the Russian supply lines. It should be borne in mind that the Russians, threatened by lack of food supplies and ammunition, had hastily fallen back in order to retain possession of their lines, and that with the IX Army in good control, it was possible for the Germans to shatter the scattered Russian corps that were marching in disorder.‡

* In three parts, of which this is the third, the preceding parts having been published in the August and September issues of the JOURNAL.

† TRANSLATOR'S NOTE: Silesia was the great industrial center, which supplied arms and munitions to the German Armies.

‡Napoleon has written in regard to the maneuver of Smolensk in 1812: "If the French Army had surprised Smolensk, we could have crossed Borysthene and attacked the scattered and disorganized Russian Army." On April 19, 1809, Napoleon explained to Massena the maneuver which he directed from Pfaffenhausen towards Lanshut, against the line of operations of the Archduke at the Isar, in the following manner: "This is the true state of affairs. Prince Charles, with his entire army, was at one day's march from

It was necessary that the preparation and execution of the maneuver be prepared both so secretly and rapidly that the blow of the IX Army would take the Russians by surprise and not give them time to prevent it. Thus by putting them in an unexpectedly dangerous situation, it would cause the demoralization which would bring about their defeat.

In all his maneuvers against rear of armies, Napoleon's first thought was to seize in rear of the enemy either a river or a defile, in order to cut off the enemy's retreat at a small cost, leaving available at the same time the bulk of his forces. Examples of this barrier are: the Adda (maneuver of Lodi); the Stradella (defile) in 1800; the Lech, 1805; the Saale, 1806; the Isar, 1809. It also

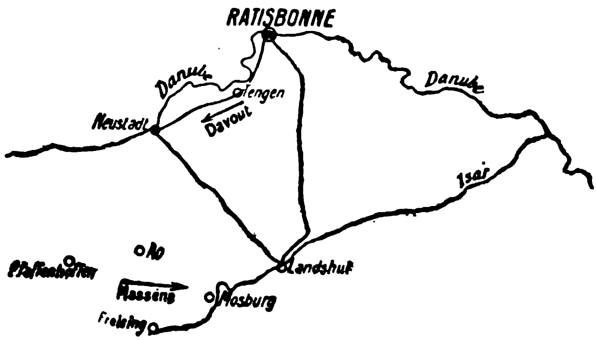

FIG. 11

served as a line of defense for the observation corps, which in his combats, Napoleon always held to check any enemy reinforcements. He had this plan in mind in 1809 at the Isar, when he ordered Bernardotte's corps and the Bavarians, to take the role of observation troops to the east of the river facing Munich.

Let us proceed with the maneuver of Lodz.

Before coming up on the rear of the Russian forces,* the IX Army had to cross the two principal enemy lines of supply and then find a line of defense where, if necessary, it could resist the attack of these Russian forces which were retreating in disorder towards

Ratisbonne this morning, and his line of operations was in the direction of Lanshut. The Duke of Auerstaedt evacuated Ratisbonne, during the night and morning, in order to move on to Neustadt and join the Bavarians. You may now see why, due to this maneuver, I hold my left, desiring the advance of the right under your command. * * * Tonight or tomorrow we will fight, probably at our left. Move the corps of Oudinot towards Au and Freising. Whether you will be ordered to move from there, depends upon the reports that I may receive today. After you have advanced upon Lanshut, Prince Charles will then discover that he has lost his line of operations, as well as the Isar which is his protection, while at the same time he will be attacked on his left. Everything here depends upon our calculation of hours."

* The 2d and 5th Russian Armies were the only ones whose lines ran to Warsaw. The lines of the 4th and 9th Armies extended towards Ivangorod, and Ludendorff depended upon the Austrian offensive for their retention at this front.

Warsaw. This line of defense would, at any rate, serve as observation corps, in order to check the Russian reinforcements sent from Warsaw and prevent them from falling upon the rear of the IX Army.

Ludendorff chose the Rawka as his line of defense. This river is a tributary to the Bzura and flows by Skierniewice, north of the Brzeziny region, where the IX Army was to be sent.

"From the critical situation in Silesia and East Prussia," writes Hindenburg, "we were to be released by the offensive of the IX Army in the direction of Lodz against the flank of the Russian main mass which was only weakly protected. It is obvious that if the attack of this army did not get home quickly, the enemy masses would concentrate upon it from all sides. The danger of this was all the greater because we were not numerically strong enough, nor were our troops good enough in quality, to pin down the Russian forces in the bend of the Vistula, as well as the enemy corps north of the middle Vistula, by strong holding attacks, or indeed mislead them for any considerable length of time. In spite of all this we intended to make our troops attack everywhere, but it would have been a dangerous error to expect too much from this.

"Everything in the way of good storm troops had to be brought up to reinforce the IX Army. *It was to deliver the decisive blow.* However great was the threat to the VIII Army, it had to give up two corps to the IX Army. Under these circumstances it was no longer possible to continue the defense of the recently freed province on the Russian side of the frontier; our lines had to be withdrawn to the Lake region and the Angerapp. This was not an easy decision. As the result of the measures of which I have spoken the total strength of the IX Army was brought up to about five and a half corps and five cavalry divisions. Two of the latter had come from the Western Front. In spite of our earnest representations, Main Headquarters could not see their way to release further units from that side. At this moment they were still hoping for a favorable issue to the Battle of Ypres."—HINDENBURG, "Out of My Life."

Ludendorff based his calculations upon the strategic deployment of the Russian Armies (See map showing the maneuver of Lodz).

The German troops were arranged from north to south, as we have seen, as follows:

Demonstration Group: (Right shore of the Vistula) north of Mlawa: Zastrow Corps, Guard Reserve Corps (less three divisions) and three landwehr divisions; from south of Mlawa to Thorn: detachments formed by the troops withdrawn from the garrison of Thorn and Gaudenz.

Left Flank: I Reserve Corps (General von Morgen), concentrated at Hohensalza, was to skirt the right shore of the Bzura in the general direction of Lowicz.

Assaulting Mass (Masse de choc). Left Wing: The XXV Reserve Corps, 3d Guard Reserve Division, Richthofen's Cavalry Corps

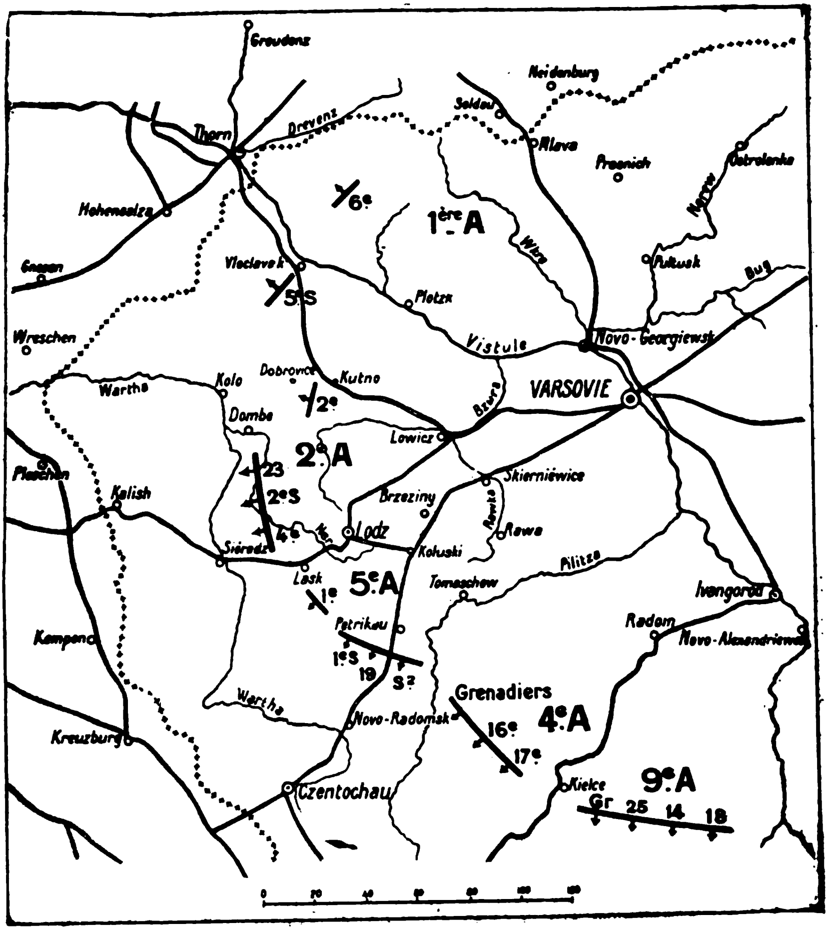

Fig. 12

(6th and 9th Cavalry divisions) in the general direction Kutno-Lowicz-Skierniewice; *Right Wing,* the XX, XVII and XI Corps, in the general direction Kolo-Dombe-Lodz.

Right Flank: Frommel's Cavalry Corps (5th and 8th Cavalry Divisions, and the 7th Austro-Hungarian Cavalry Division).

Screen: Between Pleschen and Kreuzburg: The corps of Posen and Breslau; in front of Kreuzburg, the 35th Reserve Division and the Bredow landwehr division; in front of Czentochau, Woyrsch's landwehr corps, with its right reinforced by the 1st Guard Reserve Division.

Finally, in the region to the north of Czentochau: General Boehm-Ermoli's corps, composed of the four infantry divisions and three cavalry divisions, sent by General Conrad.*

The X Army was to follow the line Thorn-Kutno-Lowicz, to assure its supply. The left of the mass of maneuver had to cover nearly 150 kilometers, before reaching the Brzeziny region. In order to open up this route, it had to crush the Russian flank guard, composed of the 5th Siberian Corps, south of Wloclawek and the 2d Russian Corps to the south of Kutno.

After having accomplished this, it had to organize its supplies, and repair the railways, which had probably been put out of service.

Ludendorff, in his calculations, could hardly have expected the left to arrive the Brzeziny region before the tenth day, but the cavalry with a small infantry, could have done so before the above mentioned day.

Let us see how Ludendorff viewed the plan of the Russians.

The 2d Russian Army was at about 75 kilometers from the Brzeziny region and could make this journey in five days. But Tannenberg had clearly demonstrated that the Russian Command was not fully developed in a strategic sense, and it would take, therefore, from two to three days for them to see the German maneuver. Then it would have to cancel the planned counter offensive towards the southwest, which was due to commence on the 14th, and also to organize the defense against the German maneuver. Since the right of the mass of maneuver would retain the corps of the 2d Russian Army and the "screen" those of the 5th Army, Ludendorff could reasonably expect that it would take at least five days before the 2d Russian Army could start towards Brzeziny, and by this time the left of the German mass of maneuver would be in front of it.

Richthofen's cavalry, supported by infantry, was to stop the Russian reinforcements sent from Warsaw and from the right shore of the Vistula as far north as possible, and was also to destroy the railways leading to Warsaw and as close to this city as possible.

The mass of maneuver had to be provided with a strong cavalry contingent, because it was the cavalry that was to stop the reinforcements from the north and also to destroy the Russian depots.

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* TRANSLATOR'S NOTE: General Conrad von Hotzendorff was at this time Chief of the Austro-Hungarian General Staff.

Ludendorff thought he could succeed and had these reasons upon which to base his belief:

1. His audacity.
2. The mediocrity of the Russians.
3. The secret code which would permit him to be informed of all the dispositions of his adversary.

"By November 10th," writes Hindenburg, "the X Army was ready. On the 11th it was off, with its left wing along the Vistula and its right north of the Warta. It was high time, for news had reached us that the enemy also intended to take the offensive. An enemy wireless betrayed to us that the armies of the northwest front, in other words, all the Russian Armies from the Baltic to, and including Poland, would start for a deep invasion of Germany on November 14th. We took the initiative out of the hands of the Russian Commander in Chief, and when he heard of our operation on the 13th he did not dare to venture on his great blow against Silesia, but threw in all the troops he could lay hands on to meet our attack. For the time being Silesia was thus saved, and the immediate purpose of our scheme was achieved. Would we be able to go one better and secure a great decision? The enemy's superiority was enormous at all points. Yet I hoped for great things."—HINDENBURG, "Out of My Life."

Let us read Ludendorff's brief account, before entering into the details of the combats.

"The Russians were taken completely by surprise, but even in the early days of our advance there was very heavy fighting, extremely expensive to both sides, near Wloclawek, Kutno and Dombe. The enemy was thrown back everywhere.

"While the main body of the IX Army pushed forward unceasingly to the Lodz-Kiliuszki Station line, General von Morgen covered their flank north of Lowicz with the I Reserve Corps. He was sorely pressed. At first he had to rely for protection on his own vigorous attacks, and then he had to meet an attack from a Russian corps which had crossed from Novo Georgievsk to the left bank of the Vistula. Due to the pressure exerted towards Mlawa by Zastrow's corps, the advance of this Russian Corps proceeded very slowly.

"The centre of the IX Army, von Richthofen's cavalry corps, the 3d Guard Division and the XXV Reserve Corps finally broke the resistance offered them. It now crossed the Lowicz-Lodz line and pushed far to the south past Brzeziny, their attention fixed on the south and west, striving after a great success. An order from the IX Army, of which I also knew, to secure its flank at Skierniewice, did not reach them. Army Headquarters was not far enough forward.

"The XX, XVII and IX Corps, which were huddled up, met a strong hostile force north of Lodz on the 17th, and engaged it. Frommel's Cavalry Corps and the Posen Corps advance but slowly on the east bank of the Warta.

"An intercepted wireless revealed to us that the Russians thought of retreating from Lodz. Our satisfaction was great. But the strong will of the Grand Duke held his forces where they were, as we learned from another wireless. We suffered a severe disappointment.

"The Russian troops on the right bank of the Vistula, with the exception of certain units which were to remain near Mlawa, were ordered to cross the Vistula. It was a good thing, that this operation was effected somewhat slowly; otherwise General von Morgen's position would have been still more difficult.

"The defeated Russian forces retreating through Skierniewice on Warsaw, were concentrated due west of the fortress, from which they were to resume their advance.

"The Russian right wing concentrated around Lodz. Reinforcements from the front of the 2d and 5th Russian Armies, which were not yet involved, pushed north on Koluczky and west of Lodz." —LUDENDORFF, "My War Memories, 1914-1918."

After having seen the general situation, as given by Ludendorff, let us go into its details.

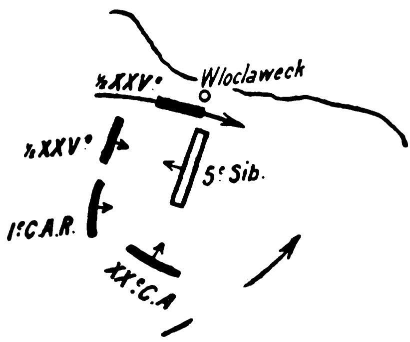

FIG. 13. COMBAT OF WLOCLAWEK

THE COMBATS

NOVEMBER 13. COMBAT OF WLOCLAWEK.—General Mackensen began operations on the 11th of November.

On the 12th, he attacked the 5th Siberian Corps in an oblique direction, south of Wloclawek, with the intention of enveloping it with three Corps: the XXV, XX and I Reserve. Richthofen's cavalry would surround the Russians by the south and cut off their retreat.

The operation was poorly conducted. The XX Corps came too close on the I Reserve Corps, thus permitting the 5th Siberian Corps to escape from disaster by executing a prompt retreat on Plotzk.

At Plotzk, this Russian Corps found the 6th Siberian Corps stationed on the right shore of the Vistula. This corps crossed the river and came to its help.

The I Reserve Corps (General von Morgen) was therefore immobilized due to a faulty execution of a battle of Cannae. The failure of the combat of Wloclaweck was one of the causes of the failure of the whole maneuver.

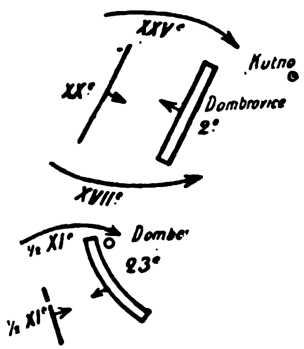

FIG. 14. COMBATS OF DOMBROVICE, DOMBE AND KUTNO

NOVEMBER 13 AND 14. COMBATS OF DOMBROVICE AND DOMBE. —Mackensen attacked the 2d Corps to the west of Kutno, intending to envelop it with the XXV, XX and XVII Corps and Richthofen's cavalry that had returned from the pursuit of the 5th Siberian Corps.

During this time, the XI Corps was holding off the 23d Russian Corps.

The 2d Russian Corps was repulsed towards Kutno.

NOVEMBER 15. COMBAT OF KUTNO.—On the 15th of November, the XXV and XX Corps reattacked the 2d Corps, which taking a new position in front of Kutno, had held the German Corps in check throughout the day. During the night, however, Richthofen with his cavalry entered Kutno by surprise. This decided the 2d Corps to retreat on the 16th. The attack against the Russian 2d Corps, was, evidently, not well executed. The German corps were too close to each other.

NOVEMBER 16.—On the 15th, Mackensen left the pursuit of the 2d Corps to the XX and XXV Corps and to Richthofen's cav-

alry and threw the XVII Corps against the 23d Russian Corps, which had already been attacked by the XI German Corps.

General Scheidemann, Commander of the 2d Russian Army, having witnessed the violence of the attacks of November 13 and 14 against the 2d Corps, reinforced the right of the 23d Corps with the 4th Corps. These two Russian Corps, the 4th and 23d, checked the efforts of the XVII and XI German Corps and the 3d Cavalry division on the 16th.

On the evening of November 16th, the 6th day of the offensive the IX German Army was on the line Dombe-Plotzk, at 80 kilometers

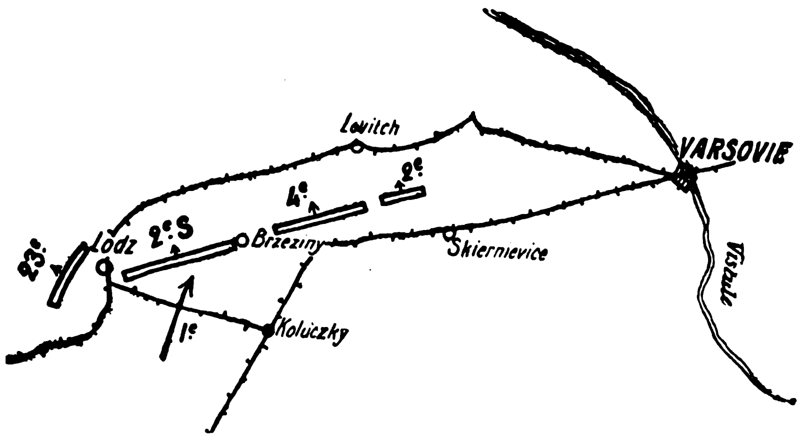

Fig. 15. Plan of the Grand Duke

from its point of departure. But the booty was relatively small, and consisted of 25,000 prisoners, 20 guns and 70 machine guns.

Counter-dispositions of the Grand Duke.—As soon as the Grand Duke Nicholas saw through the German maneuver, that is to say, probably on the evening of the 14th, he devoted himself to the preparations of the necessary steps to oppose his adversary. His idea was, apparently, to establish his front from Lodz to the Rawka ahead of the Warsaw-Koluczky railway. This railway was indispensable for the supply of his troops. This front was to be established from west to east as follows: West of Lodz, the 23d Corps; at Lodz, the 2d Siberian; then the 4th and 2d Corps. At the right of the 2d Corps came the reinforcements that were to be sent from Warsaw.

The entire 5th Army would come to the help of the 2d.

The Russians spent the 17th and 18th bringing up the 2d Corps to its new front. The rear guard covering the retreat of this corps stood violent attacks by the German "screen."

During these days, the two wings of the German IX Army became separated. The left (Richthofen's Cavalry Corps, 3d Guard Division, and the XXV Reserve Corps), having pushed to the east the remnants of the 2d Russian Corps, broke through Brzeziny as far as Koluczky.

Mackensen's wish was that these forces would establish themselves on the Rawka in order to intercept the retreat of the Russian forces towards Warsaw. But these orders were never received. They should have been given, however, previous to the advance. The German right (XX, XVII and XI Corps), in turn, after outflanking Lodz instead of obliquing towards the east in order to join the left wing and with it form the barrier, concentrated against Lodz.

THE BATTLE OF LODZ, NOVEMBER 19, 20 AND 21. (See Map).—The battle of Lodz took place on November 19, 20 and 21. The left wing of the XI Army assaulted the positions that were covering Lodz from the east and the right assaulted those at the west.

On the 21st, the Posen Corps and the 38th Infantry Division attacked to the north of Lask, in order to retain or at least to retard the 5th Russian Army, that was coming to assist the 2d Army. These German forces were repulsed by the 19th Russian Corps, which drove them to the west.

NOVEMBER 22.—On November 22d, the left of the German IX Army, which had not been able to effect junction with the right, was in turn attacked by the Russian Corps that were coming up from the south and the forces which had retreated towards Warsaw, and were now advancing towards the west. It was encircled and cut off from the German right.

NOVEMBER 24-25.—On the night of November 24-25, after bloody combats, the IX Army succeeded in not only piercing the encircling center, but also in making a large number of prisoners and collecting a large booty. The lack of ammunition in the Russian armies was already beginning to make itself deeply felt.

Mackensen established his corps so as to form a more or less continuous front from the Vistula to the north of Lodz.

The maneuver had ended and Silesia had been saved, but the annihilation of the Russian right west of the Vistula had not been accomplished. Ludendorff in his "War Memories," briefly summarizes it as follows:

"The IX Army executed an enveloping movement by immediately moving on to the east of Lodz; but as there was no counter pressure from the west, that is to say, from Kalisch, nor sufficient

cover in front of Warsaw, the Russians, coming from that portion of their front that had not been attacked and also from Warsaw, fell, in turn, upon the IX Army that was attacking from the north, and seriously pressed our forces. The German enveloping wing extricated itself from this situation by the heroic break-through at Brzeziny."

In fact, the success of the operation demanded that it be rapidly conducted. Similar to the Napoleonic maneuver at Lanshut, "everything depended on the speed of action." But Mackensen remained at Hohensalza, and Ludendorff following the traditions of the German General Staff, did not intervene in the execution.*

The situation, during the first days of December when the corps withdrawn by Falkenhayn from the Western Front (III R. II, XIII and XXIV R) arrived in Poland, did not permit Ludendorff to use these troops for a new maneuver. They were used to stabilize the front that had been considerably advanced in the direction of Lodz. This advance caused the Russians to abandon this important industrial center on December 6th. The left of the IX Army captured Lowitch and the front was pushed forward to the flats of the Bzura.

It is hardly an exaggeration to think that if Ludendorff had been able to begin his maneuver with one additional corps, or two at the most, or if the attacks against the 5th Siberian Corps and 23d Russian Corps had been conducted better, and if the role of the left wing had been more clearly indicated and understood before the commencement of the maneuver, the success of the operation might have been complete and the Russians would have been tied up for several months.

It would, undoubtedly, be very interesting to make a detailed study of the Battle of Lodz on November 19, 20 and 21, and compare it to the Napoleonic battles based on similar maneuvers, against the enemy rear, as Lena and Eckmuhl. But the documents are lacking.

THE WINTER BATTLE IN MASURIA (BATTLE OF AUGUSTOWO)

FEBRUARY 7-21, 1915

The campaign of 1914 did not bring about the decision of the war on the Western Front as sought by Moltke and Falkenhayn.

* Ludendorff bitterly reproaches himself for this. In regard to the offensive of March 21, 1918, he writes in his "War Memories": "Bearing in mind the campaign of 1914 in Poland, I have tried to exert the greatest influence in the battle, and this is a most delicate question when only one group of armies is involved. The immediate superior authority may be easily charged in such a case with needless meddling. We will use two army groups in the 1918 offensive, that of Prince Rupprecht and that of the Crown Prince, so that we may be reserved the right of intervention."

Towards the latter part of December, 1914, the Russians reached the Carpathian mountains and General Conrad, the Chief of Staff of the Austrian Army, requested the aid of the Germans in the great offensive that he was contemplating.

Falkenhayn decided to form the German Southern Army in the Carpathians, which was to be commanded by General Lizingen with Ludendorff as his Chief of Staff.

Hindenburg, however, energetically pointed out the peril to which East Prussia would be exposed in case of a withdrawal of troops and asked the retention of Ludendorff.

Returning from Posen towards the end of January, Ludendorff was informed that four new corps had been assigned to his Commander in Chief, in order to destroy the 10th Russian Army, which was a constant menace to East Prussia.

The 10th Russian Army commanded by General Sievers, consisted of four corps, from right to left as follows: 3d, 20th, 26th and 3d Siberian. Two of the four divisions of the 3d Corps were mediocre. The army itself was organized along the line Wilkowiski-Johannisburg, a front of 100 kilometers. Tilsit and Memel were occupied by the Russians.

How were the Germans going to get rid of the 10th Army?

Hindenburg and Ludendorff laid aside this time the Napoleonic scheme, with which they had only attained a partial success in the Battle of Insterburg (Masurian Lakes), and decided to adopt the scheme of Cannae, which had given them the brilliant victory of Tannenberg. Let us then follow Hindenburg and Ludendorff:

"At the beginning of the year, four army corps were placed at our disposal and transferred from home and the Western Front. They were detrained in East Prussia. Part were to reinforce the VIII Army and part to form the X Army under General von Eichorn. They deployed and separated with a view to breaking out from both wings of our lightly held entrenched position from Lotzen to Gumbinnen. The 10th Russian Army of General Sievers was to suffer deep envelopment through our two strong wings which were to meet ultimately in the East on Russian soil and thus annihilate to a great extent everything the enemy had not got away.

"The fundamental idea of the operation was put into the following words for our Army Commanders on January 8,* while we were still at Posen: 'I intend to employ the X Army, with its left wing along the line Tilsit-Wilkowiski, to envelop the enemy's northern wing, to tie him down frontally with the Konigsberg Landwehr Division and the left wing of the VIII Army, and employ the

* TRANSLATOR'S NOTE: The author evidently means January 28.

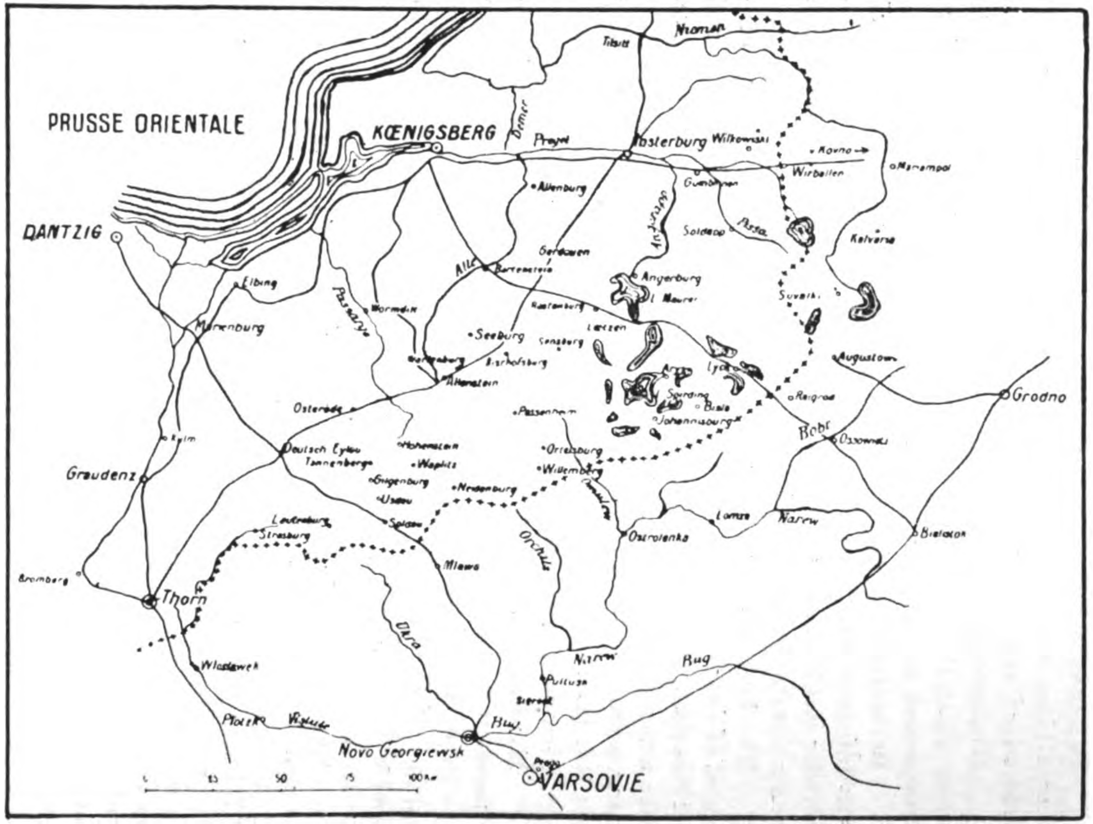
PRUSSE ORIENTALE
KŒNIGSBERG
DANTZIG
Graudenz
Thorn
Marienburg
Elbing
Osterburg
Wirballen
Grodno
Novo Georgiewsk
VARSOVIE
Ostrolenka
Bialystok
Augustow
Niemen
Narew
Bug
Mlawa
Soldau
Deutsch Eylau
Osterode
Seeburg
Angerburg
Gerdauen
Kalvaria
Suvalki
Soldeap
Wlotlawek
Plotsk

Fig. 16

right wing of the VIII Army for an attack on the Arys-Johannisburg line and south thereof'."—HINDENBURG, "Out of My Life."

"The experience of Tannenberg and the great battle of the Masurian Lakes," writes Ludendorff in his War Memories, "had shown us that a great and rapid success in battle was only to be obtained when the enemy was attacked on two sides. We now had the possibility of carrying out two enveloping movements, one from the Tilsit-Wladislavow-Kalvaria direction with a strong group of three corps (which were to be assembled between the Niemen and the road from Insterburg to Gumbinnen), and another with the XXXX Corps (Reserve), to which the 2d Infantry division and the 4th Cavalry division were attached, between Lake Spirding and the frontier from the direction of Bialla-Raigrod-Augustowo and the south. Simultaneously, the enemy was to be pinned down by a frontal attack.

"Both our opponent's wings were weak. We could hope to gain a lot of ground before the enemy forces could get away from our frontal attack. Our two thrusting wings would then surround the enemy.

"Our flank protection from Kovno and Olitta on one hand, and Ossowietz and Lomza on the other, was to be mainly assured by units of the VIII Army, which would become available due to the narrowing of front as a result of the convergence of our two flanks in a common directed towards Grodno."

The month of January was dedicated to the preparation of the operation. The troops were not moved until the last moment.

"We feared," writes Ludendorff, "that the withdrawal of troops on such a large scale from occupied Poland could not be kept secret, and might disclose our plan for an offensive in East Prussia. I attached the utmost importance to secrecy for the success of our operations."

FEBRUARY 5.—The concentration was completed on February 5th. The German General Headquarters were moved to Insterburg on this date.

"On February 5th, precise battle orders were issued from Insterburg, whither we had gone to direct the operations. From the 7th onwards, they set in motion the two groups on the wings, a movement recalling in some respects our celebrated Sedan."—HINDENBURG, "Out of My Life."

The participating forces were divided, from north to south, into two armies: the X Army (General von Eichorn) and the VIII Army (General von Below), with Darkehnen as the separating point.

The following order was issued:

(a) The flanking corps of the Niemen (landstrum of Konigsberg) must seize Tilsit and assure the line to the Niemen.

(b) Northern Enveloping Mass: the X Army, composed of three corps (XXI, XXIX and XXXVIII), the 1st Cavalry Division and the 5th Guard Brigade.

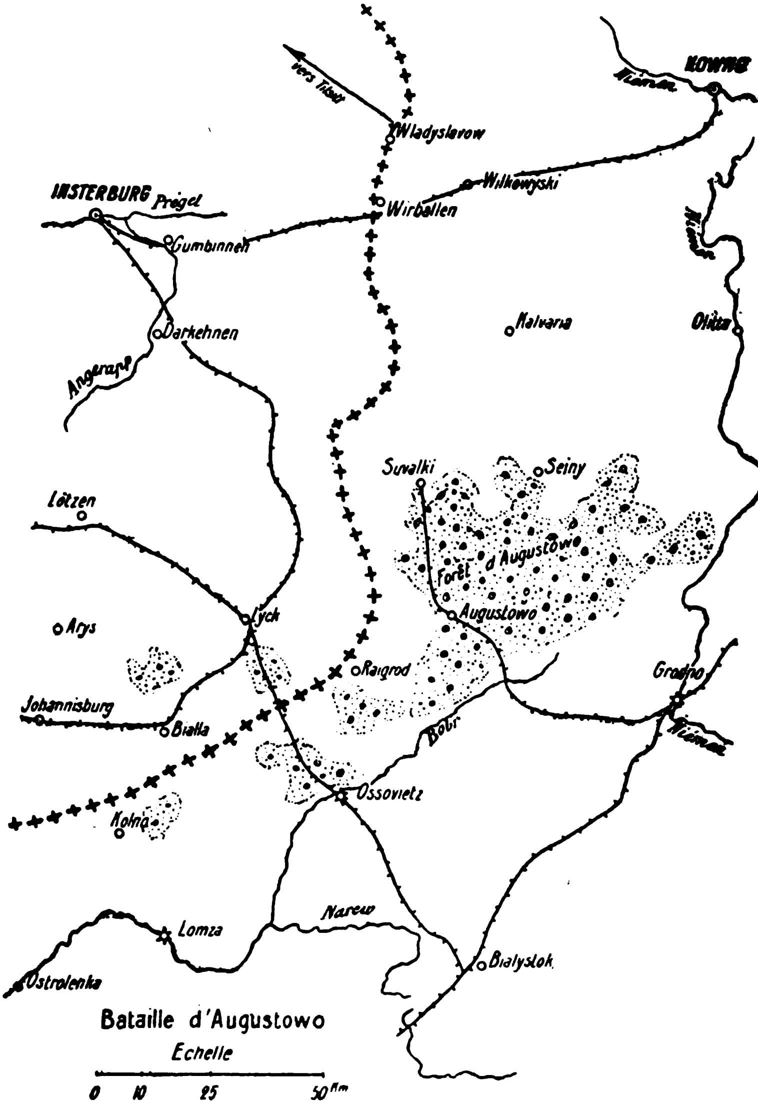

FIG. 17. THE BATTLE OF AUGUSTOWO

The landwehr division of Konigsberg is on the road to Insterburg.

(c) Front: From the Insterburg road to Lake Spirding. It comprises the 2d Reserve Division and 3d Landwehr Division, strongly combined with landstrum and five infantry brigades.

(d) Southern Enveloping Mass: Furnished by the VIII Army. It comprises the 2d Infantry Division west of Johannisburg with the XXXX Corps to its south and extending to the frontier. The 4th Cavalry Division will concentrate to the rear. The XX Corps, detached from the IX Army, will debark at Ostelsburg to be transported to Lomza, in rear of the southern mass. This corps must advance towards the Narew through Mychnietz.

(e) Southern Flanking Corps: Facing Lomza, under the command of General Ascholtz.

(f) Cover between the Orchitz and the Vistula: Army detachment under the command of General von Gallwitz, which must advance to the south as soon as assembled. Thereafter, the best cover in this region will be furnished by the offensive of the VIII and X Armies.

It should be noted that the northern mass consisted of three corps and one cavalry division, while the southern mass only consisted of one and a half corps and one cavalry division.

"I did not find it easy to start the army off on its task," writes Ludendorff. "The winter was cold. An exceptionally fierce snowstorm had been raging since the 4th or 5th of February; roads and railways were buried, and it was difficult to get ahead off the beaten track. Snowdrifts, as high as a man, were succeeded by bare places covered with thin ice. However, no alteration was made in the original scheme. The Russians had even greater difficulties to contend with, because their supply trains had been sent on ahead.

"Our troops were equipped for a winter campaign, and the mortars had been provided with snowshoes, though these proved later to be unpractical, for they could not be used on roads which were only covered with snow in places.

"The feats performed by man and horse during the following days are beyond description. * * * It was lucky that by our wide encircling movement we captured provisions from the enemy's provision columns, for otherwise the whole operation would have had to be broken off through failure of supply.

"The commands and the subordinate staffs had to face extraordinary difficulties. It was a long time before the battle-worthy units could be brought up when an engagement with the enemy took place. Orders could not be transmitted, wires were broken down by the storm and messages did not arrive."—LUDENDORFF, "My War Memories, 1914-1918."

THE BATTLE, FEBRUARY 7-21.—The Russian Army was taken by surprise.

"Our intelligence service," writes Ludendorff, "did good work by spreading false rumors and preventing the enemy from obtaining information."

SOUTHERN ENVELOPING MASS.—On the 7th, General Litzman arrived in front of Johannisburg with the right wing of the VIII Army. On the 8th he took Johannisburg, and with his flank secured against any enemy movement from Ossowietz, pressed forward to Raigrod, where he met with strong opposition. At the same time, the left wing of the VIII Army, following close on the heels of the enemy, was approaching Lyck.

Lyck, which was splendidly defended by the 3d Siberian Corps, fell on the morning of the 14th. This corps escaped annihilation and withdrew via Augustowo behind the marshes of the upper Bohr.

By the night of the 16th-17th, General Litzman was in Augustowo after further heavy fighting.

NORTHERN ENVELOPING MASS.—Its maneuver was "perfectly executed."

"By the night of the 10th-11th, after extraordinary forced marches and incredible efforts, the centre of the X Army, moving on the Tilsit-Kalvaria line, had reached the Insterburg-Kovno road near Wirballen. The 3d Russian Corps escaped to the north, instead of towards the centre and the X Army permitted its escape.*

"On the 14th, when Lyck fell, our infantry columns were already due north of the great Augustowo forest near Suwalki-Seiny. The retreating Russian Army was attacked vigorously in the flank and forced southwards.

"On the evening of the 14th it seemed as though it would be possible to complete the envelopment of the enemy due east of Augustowo. General von Eichorn diverted his left wing in this direction. On the 15th and 16th the advance guard of the XXI Corps advanced on the Seiny-Augustowo "chaussee" (road), far into the forest, but here they were overrun by Russian columns pouring back eastwards, and part of the German forces were made prisoners. Up to February 18th, forces of the 10th Army pushed on boldly along the northern edge of the forest to the vicinity of Grodno. Here they took up a position facing west with their rear close to the fortifications. This bold and venturesome movement cut off the enemy's retreat."—LUDENDORFF, "My War Memories, 1914-1918."

Other units of the X Army were plunging through the forest, joining the forces of the VIII Army, and closing the circle around the 10th Russian Army. This army was surrounded by German forces, but the situation of the German armies also had its difficulties.

"On the 20th and 21st, violent attacks were made from the fortress of Grodno, where the Russian reinforcements had assembled.

* The retreat of the 3d Russian Corps was similar to that of the 5th Russian Corps at Tannenberg.

The Russians also made repeated attacks from the Augustowo Forest, into which they had poured in their retreat. The German troops stood firm, though suffering heavy losses.

"A few days later the masses of Russian troops surging in the Augustowo Forest and defending themselves desperately, surrendered. The battle was at an end."—LUDENDORFF, "My War Memories, 1914-1918."

"And," writes Hindenburg, 'it was indeed a Sedan which finally befell the Russian 10th Army in the region of Augustowo. It was there that our mighty drive came to an end on February 21st, and the result was that more than 100,000 Russians were made prisoners and an even larger number of Russians were killed. On the orders of His Majesty the whole affair was called the "Winter Battle in Masuria."—"Out of My Life."

"The tactical results of the winter campaign in Masuria were important: 100,000 prisoners and hundreds of guns. The Russian 10th Army had been annihilated and Russia's strength was once more perceptibly reduced."—LUDENDORFF, "My War Memories, 1914-1918."

CONCLUSIONS

Of the three battles conducted by Ludendorff in the Russian front from 1914-1915, the first—Tannenberg—was the scheme of Cannae; the second—Insterburg—was the Napoleonic scheme, and the third—Augustowo—was again the scheme of Cannae.

Ludendorff, in order to justify himself for his return to the scheme of Cannae, writes: "The experience of Tannenberg and the great battle of the Masurian Lakes had shown us that a great and rapid success in battle was only to be obtained when the enemy was attacked on two sides." Let us see whether or not Ludendorff is justified in his conclusion.

TANNENBERG.—Tannenberg was a brilliant victory, indeed. Ludendorff, with forces much inferior in number to Samsonov's army, was able to crush this army and take it, in part at least, prisoner. His judgment in the adaptation of the scheme of Cannae was sound. This consisted in shaking off the corps at the flanks and then encircling the three corps at the centre.

It must not be forgotten, however, that he had exact knowledge of all the adversary's steps, which is a luck seldom had by any general. Moreover, the Russians placed themselves in front of him. Samsonov committed suicide instead of extricating himself from the encirclement by attacking one of the enveloping masses. The corps at the flanks, after being reorganized, only thought of putting them-

selves out of reach, instead of advancing against these German masses.

INSTERBURG.—Ludendorff decided to adopt the Napoleonic scheme, because having at his disposal only eight divisions against the Russians' twelve divisions (the latter also occupying a fortified line). He could not form the two enveloping masses of the scheme of Cannae. It is also probable that he was influenced in his decision by the French success at the Battle of the Marne.

The corps at the front, however, could not pin down the Russians. Rennenkampf only thought of retreating as soon as he saw the turning movement. He also left 45,000 prisoners and an immense booty in the German hands. It is possible that Rennenkampf would not have allowed himself to be surrounded by the scheme of Cannae. In order to accomplish this, it would have been necessary to put into execution a Napoleonic maneuver against the rear of the Russian Army, and this Ludendorff did not dare to undertake.

AUGUSTOWO.—At Augustowo, after several vicissitudes, the majority of the Russian 10th Army was made prisoner.

Judging from the successes of the battles of Tannenberg and Augustowo, we may be led to believe that Hannibal's scheme is more successful in modern warfare than Napoleon's scheme. It must be borne in mind that while the Russian troops made the Germans pay a good price for their successes, the Russian Command, however, did not seem to react, and also Ludendorff was perfectly informed of the enemy dispositions.

On the other hand, we have seen that in the combats which preceded the battles of Lodz, Wloclawek and Dombrovice, the Germans did not succeed in carrying out the scheme of Cannae, and that, first the 5th Siberian Corps, and afterwards the Russian 2d Corps succeeded in escaping.

With the aggrandizement of the battle front, the chances of an encirclement decrease, while on the contrary, the possibilities of the adversary being able to crush one of these turning masses in his efforts to keep off the other, increase.

The superiority of the scheme of Cannae, with the means of modern warfare is, therefore, a subject of contention.

EDITORIALS

Another Change

FOR the tenth time since the organization of the JOURNAL OF THE UNITED STATES ARTILLERY, more than a third of a century ago, its editorship has changed hands. The call of other duty, that intermittent but always-to-be-expected call which we all know, has taken Major Joseph A. Green, C. A. C., from the editorial desk to other fields of endeavor. During his too-brief period in charge of the destinies of the JOURNAL, Major Green has been eminently successful. In every department progress has been evident under his regime. To his instictive ability to produce a periodical interesting and instructive to its readers he added a business acumen which has placed the JOURNAL upon a sounder basis than ever before. The JOURNAL considers his departure as distinctly a loss, and feels that its readers will join with it in wishing Major Green the greatest of success in his future career.

The Shenandoah

Two years ago the naval dirigible *Shenandoah*, then the *ZR-1*, took the air at Lakehurst, New Jersey, on its trial run. Its construction had continued over a period of four years and it represented the last word in airships. The disasters to the *ZR-2* and to the *Roma* had contributed to the improvements in the *Shenandoah* In its design and in its construction, the utmost care had been exercised. So far as was humanly possible, this, our first attempt at large dirigibles, was a perfect product.

Throughout its career the *Shenandoah's* performances justified the confidence of its designers and builders. On short trips and long trips, in fair weather and foul it proved its air-worthiness. In no respect did it indicate forth-coming disaster, and yet disaster was its end. On a recent trip to the west, while over Ohio, the *Shenan-*

doah, without warning, broke into three parts and crashed to earth, with the loss of life of its commander, Zachary Lansdowne, and a number of other members of the crew.

The Navy Department is conducting an inquiry into the cause of the wreck, and until its findings are published it would be idle to speculate on the cause of the disaster. Testimony of witnesses is conflicting. Experts do not yet agree on the probable points of weakness,—whether they be too few safety valves, incorrect bracings, disintegration of structural materials, or other cause; and until the cause of the disaster is determined, lessons cannot be drawn therefrom. That there are lessons is unquestioned. In the air service, as in other lines of endeavor, we learn by our mistakes; and in the air service, as in other lines, we continue to progress despite mistakes. Other countries have lost airships and are continuing to construct other airships. We shall undoubtedly do the same; and we may anticipate having before long in the Navy, or in the Army, or in some other service, airships better constructed and better performing because of the loss of the *Shenandoah*.

To our sister service in her hour of loss we extend our utmost sympathy. To the families of the heroes who met their death in the wreck we can only say in consolation: "They died in line of duty."

Rating Coast Artillery Organizations

The question of changing the present method of rating Coast Artillery Organizations is being considered in the office of the Chief of Coast Artillery. It is realized that if a satisfactory method of awarding a figure of merit for excellence in gunnery could be devised, and the same published annually in orders, it probably would result in better trained units and better preparation for war conditions.

At present, ratings of Target Practices only are made in the office of the Chief of Coast Artillery, and are based on a study of the target-practice reports and the information and recommendations contained in the forwarding indorsements thereon. A recent Bulletin showed that, for the 1924 target practices, 10 batteries were rated excellent; 35 very good; 178 satisfactory; and 23 unsatisfactory. These ratings, however, do not show the relative merit of the batteries in the various classifications,—a necessary condition if real competition is to be had.

The rating of Coast Artillery Organizations is now made by the Coast Artillery District Commanders in compliance with paragraph 35*d* (2) TR 435-55 and includes Target Practice as one element of the general efficiency of the organization.

The JOURNAL realizes that many officers of the Corps have ideas of one kind or another on the question of rating. If the ideas of these various officers could be brought together, they might be of material assistance in determining a suitable method for arriving at a figure of merit, provided such a method were eventually decided upon. The JOURNAL will appreciate the opinion of any officer upon this subject.

Always Unready

[Reprinted from the *Detroit Free Press*]

In his final article of a series describing the activities of the American Army throughout the prevalent summer months, General Pershing makes a special plea for adequate national preparedness, remarking significantly that there is a great difference between a nation that believes in preparedness and a nation that is actually prepared.

This difference is fully demonstrated by the situation in the United States today. Despite the prevalence of a few pacifists, there is not the slightest doubt that America understands the need of adequate means of defense, and fully subscribes to the declaration by George Washington that "to be prepared for war, is one of the most effective means of preserving peace." That declaration indeed is impossible of contradiction by any person with eyes in his head. It is axiomatic. It has been repeated in words more or less similar by hundreds, both before and since the time of Flavius Renatus Vegetus, who gave it the classic phrasing: "Let him who desires peace prepare for war."

But General Pershing is strictly within the truth when he says:

> There never has been adequate preparedness in this country. We have come out of all wars with the best of intentions and high resolves henceforth to be prepared to preserve our peace and liberty. But those resolutions like those made by so many each New Year have always been broken. After each war, we have lapsed into our old habit of neglect. Temporary expediency has always tempted us to keep whittling down our military establishment. Always to our great surprise, war, with all its confusion and cost in lives has come to us, largely because of our weakness.

The record shows that General Pershing is right. Time after time we have been penny wise and pound foolish and have extricated ourselves from the result of our folly only at great cost both in lives and money. As Pershing puts it, "It is not economy to save thirty million dollars a year on national defense, and then spend thirty billions in two years during war."

It is true, of course, that the relapse into a fool's paradise has been less violent in the United States since the World War than it was on other occasions. The demoralizing efforts of the professional pacifists have to quite an extent been neutralized, and there is more general interest in preparedness among the rank and file of the citizenship of America than ever before. The success of the summer training camps and of the R. O. T. C. movement has been large, and if interest can be maintained, the result will be a comfortable presage to continuing peace, or at least of a preparedness which will carry us through a war at considerably less cost and suffering than otherwise.

But it also is true that the precautions which are being taken are far from adequate. That is indicated by the circumstance that General Pershing still finds it necessary to plead for a regular army establishment of at least thirteen thousand officers and one hundred and fifty thousand men as a first line of defense and as instructors of civilian soldiers. All the experts agree that this should be a minimum but congress pays no attention to the recommendations and warnings.

Self Protection

Self protection is instinctive with all of us. We, as human beings, seek to assure the continued existence, well-being and safety of ourselves, our families and our property. For that reason we carry life insurance, burglary insurance, fire insurance and accident insurance. In one department, however, we are prone to be negligent.

From figures recently released by the United Services Automobile Association, we find that, of the approximately 4,000 commissioned and warrant officers and field clerks of the Army, Navy, Marine Corps and Coast Guard Service insured in that association, 2,511 were involved in accidents. Of these, 2,505 claims were paid—an amount exceeding $50,000, while but six claims were disapproved.

A great majority of army officers possess automobiles and are reasonably skilful drivers; yet all are subject to accident. It is true, of course, that the ratio of automobile accidents to the number of automobiles in use is continually decreasing, but the rapidly increasing number of automobiles in use brings about an increase in the total number of accidents. This has resulted in proposals in more than one-half the states for compulsory insurance, which the JOURNAL, however, considers but an ineffective method of protection against loss.

It is important that the automobile owner protect himself and his family against the particular form of loss or damage, and to the particular extent which he feels necessary. Above all, he should be protected against personal liability. It is estimated that not more than twenty per cent of all automobile owners carry liability insurance, and it is further estimated that at least one-half of all owners involved in personal injury accidents are unable to meet a judgment in damages. A great many officers of the Army will fall under this latter class, and the JOURNAL, therefore, cannot recommend too highly the protection resulting from insurance.

More Annapolis and West Point Academies Needed

[Reprinted from the *Washington Herald*]

From time to time this newspapepr has set forth the nation's need for more naval academies like Annapolis, more military academies like West Point. This need never has been more imperative than it is today.

There is a common idea that Annapolis and West Point make only fighters. The idea is wrong. These two national academies teach young Americans not only how to defend their country in war, but also how to serve their country in peace. They teach American young men why this is a country worth defending, how the United States was built up to be the nation that it is today, what has been done and by whom to rescue it from a mere colonial existence like Canada's, who have made the sacrifices to save it from an arrested development like Australia's, why the nation is no loose cluster of States, like Germany, but a close and indivisible Union, and over and above all why, only by his whole-hearted loyalty and his single-hearted devotion, the good citizen can help preserve and perpetuate the institutions that safeguard the comfort, progress, well-being and liberty of all.

The National Guard

[Reprinted from the *Washington Star*]

The War Department has notified the national guard organization in 24 States, the District of Columbia and Porto Rico that they shall stop further recruiting as they have reached the strength for which funds were alloted them for the current fiscal year. From one point of view this is exceedingly satisfactory. What seems regrettable is that the patriotic willingness of the citizens of the United

States to serve in the national guard should have to be thus checked, as it is clear that if this step had not been taken to stop recruiting a still greater number of men would have come forward. An effective of 177,000 men seems a very small one for a country with a total population of over 110,000,000, as it represnts only one-sixth of 1 per cent of the population.

In Great Britain, with a population of less than 50,000,000, the territorial army, the organization corresponding to the national guard in the United States, numbered before the world war, over 300,000 men, or proportionately almost six times the peace effective of the national Guard. Small as this force was, it was of immense service to the country, as it enabled the military authorities to reinforce the expeditionary force of 150,000 men sent to France at the outbreak of the war by an additional 100,000 men within a few weeks' time. Small as this reinforcement was, it proved at that time to be of priceless value.

The plans of the War Department called for 80 American divisions on the Western front by June 30, 1919, and for a reserve of 18 divisions at home, a total of 4,850,000 men. All of the plans for training were built on this scale and at the signing of the armistice on November 11, 1918, these plans were in full operation. On August 7, 1918, the distinguishing characteristics of the Regular Army, National Army and National Guard were discontinued, and all the military forces of the Nation were united in the United States Army. In November, America had 31 per cent of the Allied troops in France, Great Britain had 28 per cent, and the French 41 per cent. The size of the Army had increased from 190,000 to 3,757,624 men, of which 2,086,000 reached France. In the Meuse-Argonne offensive, 29 American divisions were in line, upholding the finest traditions of the service. The Coast Artillery had grown in this time from 21,000 men to 137,000 in November, 1918.

PROFESSIONAL NOTES

Coast Artillery Training Activities—1925

EDITOR'S NOTE: *In a letter to the Adjutant General of the Army dated August 26, 1925, the Chief of Coast Artillery submitted the following review of Coast Artillery Training Activities for the Fiscal Year 1925. The* JOURNAL *considers these remarks of the Chief of Coast Artillery, together with his recommendations, to be of interest to all officers of the Coast Artillery Corps.*

GENERAL.—During the fiscal year 1925 the training of the personnel of the Coast Artillery Corps has been carried out in conformity with the War Department's Training Directives for 1924 and 1925. This conformity to War Department instructions has resulted in a marked improvement in all phases of regimental training, with but very few exceptions.

The good results in training have, nevertheless, been accomplished under most adverse conditions due to the following causes:

a. Insufficient training personnel now allotted to the regiments garrisoning the several harbor defenses within the continental limits of the United States.*

b. Training programs of a too comprehensive nature required to be carried out by the undersized regular regiments. These plans require the necessarily small firing batteries to be proficient in the use of two, and in some cases, three different classes of armament. These manifold duties are necessary in order that the National Guard and Organized Reserve regiments, the R. O. T. C. and C. M. T. C. personnel may be properly trained in the tactical empoloyment and firing of the different classes of armament.

c. Insufficient funds to provide the required artillery boat service in many harbor defenses, for use in the towing of targets and in the running of drill courses simulating the action of hostile war vessels in attacking land fortifications.

d. Lack of suitable airplanes carrying artillery observers, these planes being required for the towing of sleeve targets for the target practice of all antiaircraft artillery regiments.

e. Lack of the latest types of antiaircraft artillery materiel including guns, listening devices, and self-contained range finders.

f. An insufficient allowance of target practice ammunition for all firing batteries.

g. The large amount of non-military work required of the personnel of all regiments in the upkeep of military posts.

Training inspections have been made, under the provisions of A. R. 265-10, of all the regular regiments of the Coast Artillery Corps located in the conti-

* 3394 enlisted men in 19 harbor defenses within the United States.

nental limits of the United States by representatives of this office. These inspections have invariably brought out the fact that training programs now in vogue are of a too crowded character and in consequence of this fact regimental commanders find it difficult to maintain a high state of morale in their commands. These inspections have proved to be most beneficial due to the fact that the inspecting officers have done much to standardize the methods of instruction in the several regiments in accordance with the provisions of the latest training regulations.

GUNNERY.—A special effort has been made during the last training year to require all batteries trained to fire on naval targets to conduct target practice under the provisions of the new T. R. 435-221 "Fire Control and Position Finding." A similar effort has been made to standardize in accordance with the latest regulations, the fire of all antiaircraft gun and machine gun batteries.

The results of the firings against simulated naval targets indicate considerable improvement in this class of fire for the year. There has been an increase in the number of hits per gun per minute, and in the firing ranges, and a decrease in the times of making adjustments from observation of fire by battery commanders. However, there is still much room for improvement in this class of firings which can be accomplished only by the intelligent and untiring efforts of all officers of the corps on duty with the several regiments manning armament designed to fire on naval targets.

A new departure has been made consisting of the holding of one target practice in each Coast Artillery district during which the battery personnel is subjected to a gas attack. These firings have emphasized the need for gas masks suitable for the personnel operating telephones and optical instruments.

Under War Department instructions of April 18, 1925, exhaustive antiaircraft service training is now being conducted by the 62d Coast Artillery (AA) at Fort Tilden, New York, in conjunction with the Air Service personnel located at Mitchell Field, L. I., with a view to determining the efficiency of antiaircraft gun and machine gun fire against air targets and the ability of searchlights, directed on data furnished by listening devices, to pick up planes at night and to hold them in their beams. In order that a satisfactory volume of fire may be obtained, this training is being conducted by firing batteries, manning four guns and eight machine guns of the pattern now supplied to the service.

Up to June 30th the firings held at Fort Tilden have not been sufficient to permit the formation of an estimate of the degree of efficiency of antiaircraft fire. Practice is being held with sleeve targets towed by planes under conditions simulating as nearly as the required safety regulations will permit the actual conditions of war. However, the firings held by the 62d Coast Artillery (AA) and similar ones held during the year by other antiaircraft regiments of the Corps have shown that it is possible to hit the sleeve target with antiaircraft gun fire as often and with as small an expenditure of ammunition as is required by other classes of artillery in firing upon naval and land targets.

In order that a healthy rivalry in all classes of target practice may be stimulated throughout the Corps this office has issued tables showing the results of all firings of the regular regiments assigned to fixed, railway, antiaircraft, and heavy tractor drawn artillery materiel held during the calendar year 1924. It is believed that these tables will be the means of stimulating a healthy interest in the target practices to be held during the coming season.

Requests have been made to all regimental and artillery district commanders to submit reports at the end of each target practice season, covering in detail the results obtained at all practices held by the units of their commands and setting forth what steps they have taken to improve the methods and accuracy of fire.

It is only by a careful and intelligent supervision over all firing on the part of senior Coast Artillery officers that good results in gunnery may be obtained.

TACTICAL EMPLOYMENT.—The development of correct methods of tactical employment of the several classes of Coast Artillery units has received attention during the year.

In the majority of the harbor defenses, both in the United States and abroad, tactical problems involving the employment of all the elements of defense have been successfully solved from time to time, in connection with tactical inspections of superior officers, and during war condition periods, set to determine the efficiency of existing war plans.

At the Coast Artillery School, a special study is being made of the correct tactical employment of the units of the antiaircraft service assigned to field armies. This study includes matters pertaining to the organization of antiaircraft regiments, and the tactical control of the regiment and the brigade assigned respectively to the corps and army. I again desire to renew my recommendation made to the War Department on January 13, 1925, that the tactical control of the antiaricraft regiment in the corps and of the brigade in the army be directly under the commanders of these units and not exercised through the corps and army chiefs of artillery.

TRAINING REGULATIONS AND ARMY CORRESPONDENCE COURSES.—Satisfactory progress has been made in the preparation of Coast Artillery training regulations during the year with a special effort toward the preparation of these regulations pertaining to railway and tractor drawn Coast Artillery.

The training regulation on gunnery for fire against naval targets has been revised, and brought up to date together with the methods of fire control and position finding for fire on such targets. Antiaircraft gunnery is now being revised and will not be reissued to the service until after the results of the extensive firings now being held at Fort Tilden can be studied so that any new method developed during these firings may be introduced into the new text.

Ten (10) training regulations have been prepared during the year and printed and distributed to the service, making a total of thirty-four (34) Coast Artillery training regulations prepared and printed to date. Nine (9) training regulations have been prepared and are in the hands of the Adjutant General in process of being printed, and in addition, thirty-eight (38) authorized by the War Department are yet to be completed.

All Coast Artillery parts of the new Army Correspondence Courses are being prepared by the Department of Correspondence Courses at the Coast Artillery School in accordance with War Department instructions. These courses are being simplified, and presented in a much more interesting manner to the students. An effort has been made to clarify the method of instruction on artillery materiel by means of simplification in the explanation of its operation and by the use of numerous cuts of materiel which will be oontained in a special regulation on Coast Artillery Materiel.

THE COAST ARTILLERY SCHOOL.—The outstanding features in this year's work at the Coast Artillery School have been the lengthening of the Advanced Course

from 5½ to 9 months with a consequent increase in efficiency, and the establishment of the Department of Correspondence Courses. The Department of Correspondence Course is now also charged, under orders from this office, with the preparation of the text of all Coast Artillery training regulations, and the Department of Military Art with the development of policies pertaining to the organization and tactical employment of the several classes of Coast Artillery units.

A Refresher Course for senior officers of the Coast Artillery Corps has been inaugurated and a few senior officers of the Corps assigned thereto, this course being the same as that designed for general officers, and normally lasting three (3) months.

If sufficient funds are available it will be the policy of this office to send, from time to time, senior officers of the Corps to take this course before such officers are ordered to assume command of regiments, this being done in order that they may be made familiar with the latest methods of Coast Artillery technique.

The following table shows the courses which were given in the Coast Artillery School during the past year, together with the number of officers in attendance and the number graduating:

Course	*Duration*	*Number of Officers Attending Course*	*Number of Officers Completing Course*
Advanced Course	9 months	36	34*
Advanced Engineering Course	4½ months	6	6
Battery Officers' Course	9 months	49	48†
Refresher Course for General and Field Officers	1-3 months	2	2
Special Course for National Guard and Reserve Officers	6 weeks for N. G. 8 weeks for O. R.	15 Nat'l Guard 8 Org. Res.	15 Nat'l Guard 8 Org. Res.

* Includes 1 Cuban Army Officer. † Includes 2 Cuban Army Officers.

The following courses for enlisted men were also given:

Course	*Duration*	*Number of Enlisted Men Attending Course*	*Number of Enlisted Men Completing Course*
Artillery Course	9 months	6	4
Engineering Course	9 months	25	22
Radio Course	9 months	13	9
Clerical Course	9 months	34	28
Special Diesel Engine Course	10 weeks	9	9

I again desire to renew my recommendation of last year relative to increasing the number of officers allowed to attend the Battery Officers' Course. It is earnestly desired that every officer of the Corps should be allowed the privilege of receiving instruction in the Battery Officers' Course before he reaches the grade of field officer.

Coast Artillery Organized Reserve Training.—The predominant features of the training of Organized Reserves during this year have been the training of units assigned to heavy tractor and railway artillery, the more intimate supervision over active and inactive training by unit executives, the increased interest

taken in the Army Correspondence Courses, the inauguration of periodical conferences on artillery subjects in certain centers containing a number of Coast Artillery officers, and the training of officers for wartime duty in this office and at the Coast Artillery School.

Up to this time it has not been possible to train properly in antiaircraft methods the personnel of the seventeen (17) antiaircraft artillery regiments located in the center of the United States, owing to the fact that no regular Coast Artillery antiaircraft regiment is available to form a training center for this class of work. Funds have been available to send only a few of the officers of these regiments to any of the three regular antiaircraft regiments located on the seacoast of the United States. Arrangements have been perfected to train this personnel, both National Guard and Organized Reserves, at Fort Sill, Oklahoma, and Camp Sparta, Wisconsin. To assist in this training, regular Coast Artillery teams will be sent from the nearest antiaircraft regiments located on the seacoast. This arrangement is not entirely satisfactory, and proper training can be given to these units of the Organized Reserves and the three National Guard regiments located in the center of the country only by organizing and stationing a regular antiaircraft regiment manned by Coast Artillery personnel of the regular army at some point located in the central part of the United States. Such action can be taken only by allowing an increase of 300 in the number of enlisted men assigned to the Coast Artillery Corps. An additional allowance of 20 Coast Artillery officers on duty with the branch will also be necessary.

A marked improvement in the number of Reserve officers taking Correspondence Courses has taken place during this year and at the present time 814 officers are taking one or more courses. This number is about 22½ percent of the number of Reserve officers of the Coast Artillery Corps.

Satisfactory training of the personnel of the Organized Reserves can be accomplished only by detailing one officer per each regiment or equivalent unit as unit executive with a mileage allowance which will permit him to come in contact with the officers of his regiment at least once each quarter.

Camps for Organized Reserves of all classes of Coast Artillery units were held during this year at nine regular Coast Artillery stations at which there was trained the personnel of 14 regiments which is about 20 per cent of the number of units now organized.

A more liberal allowance of target practice ammunition for the individual firing problems for the training of Reserve Officers should be allowed.

RESERVE OFFICERS TRAINING CORPS.—The academic year just completed at institutions where Coast Artillery R. O. T. C. units are installed is the first one under which these units have been trained pursuant to the new course of instruction. This course of instruction has proved to be the most satisfactory and tends to produce graduates well qualified to perform the duties of 2d Lieutenants in regiments whose mission it is to fire on naval or air targets.

The lack of a Coast Artillery unit in the Second Corps Area is becoming more acute every year. Fordham University has been chosen by this office for the installation of a Coast Artillery unit and the officials of that institution have petitioned the War Department for authority to establish such a unit. Favorable action has not been taken by the War Department owing to the nonavailability of funds for the purpose. It is urgently recommended that this unit be established at as early a date as possible and also that one additional unit be allotted to the Coast Artillery Corps to be established in the Second Corps Area.

Coast Artillery R. O. T. C. units are established as follows in the several Corps Areas together with number of students:

First Corps Area	2 units	582 students
Second Corps Area	0 units	0 students
Third Corps Area	2 units	948 students
Fourth Corps Area	4 units	1070 students
Fifth Corps Area	1 unit	439 students
Sixth Corps Area	2 units	437 students
Seventh Corps Area	4 units	1398 students
Eighth Corps Area	0 units	0 students
Ninth Corps Area	3 units	1059 students
Total	18 units	5913 students

259 graduates of the above institutions were commissioned this year as 2d Lieutenants, Coast Artillery Reserves.

The following R. O. T. C. Camps were held this year with the attendance as noted:

Fort H. G. Wright, New York	50
Fort Monroe, Virginia	254
Fort Barrancas, Florida	89
Fort Casey, Washington	41
Total	434

Citizens Military Training Camps.—Coast Artillery C. M. T. Camps were held during this year at six (6) different locations with an attendance of 1378.

The results obtained at these camps has shown a healthy improvement in so far as Coast Artillery training is concerned. However, there is grave doubt as to whether the graduates of the Blue Course, without further training, make efficient 2d Lieutenants of the Coast Artillery Corps. It is believed that these officers should be commissioned provisionally upon graduation from the Blue Course, and that they should not receive their final commission until they have attended at least one camp with the Reserve regiment to which they are assigned.

Recommendations for Changes in Annual War Department Training Directive.—I desire to recommend the following changes and additions to be embodied in the next issue of the War Department Training Directive in so far as the training of the personnel of the Coast Artillery Corps is concerned:

a. That the period to be devoted to the training of the civilian components of the Army by any regular Coast Artillery regiment be of not more than two (2) months duration in any training year.

b. That should conditions arise whereby Reserve regiments would receive their training at any other time than during the period mentioned in *a* at places where units of the regular Coast Artillery are stationed, the program of such Reserve training should conform as nearly as possible to that of the regular command. By this method it will be possible for the regular regiments to complete their training without undue interference by Reserve organizations.

c. That I, or my representative, be authorized each year to visit all stations at which regular Coast Artillery regiments are located in order to make the training inspection under A. R. 265-10 and to ascertain the condition of all Coast Artillery materiel located thereat.

d. That a representative of this office be authorized to visit each Coast Artillery Reserve Officers Training Corps unit once during the academic year.

e. That I, or my representative, be authorized to visit at least once each summer the Coast Artillery training camps located in each Corps Area with the exception of the Ninth.

f. That steps be taken to provide in each harbor defense, suitable artillery boat service for the towing of targets and for the simulating of the action of attacking war vessels for drill purposes. It is especially desired that a suitable boat be stationed in Hawaii for this exclusive purpose, which now is not the case.

Seacoast Artillery Firing

[COAST ARTILLERY BOARD PROJECT No. 220]

EDITOR'S NOTE: *Coast Artillery Board Project No. 220 is one of the most important and most interesting projects ever undertaken by that Board. The* JOURNAL *regrets that the length of the project is such that it can not be given in full in these pages. However, the project, with omissions reduced to a minimum, has been secured from the Coast Artillery Board for publication in this and the two succeeding numbers of the* JOURNAL. *The action of the Chief of Coast Artillery on all parts of the project published herein will appear with the final installment.*

HISTORY OF THE PROJECT

1. During the past two years the Coast Artillery Board has submitted approximately 225 projects affecting the Coast Artillery service. Most of these projects have a direct bearing on Coast Artillery Doctrine and Fire Control methods, including preparation and adjustment of fire. The recommendations of the Coast Artillery Board contained in the various projects have been approved, in general, by the Chief of Coast Artillery. The projects have been prepared and forwarded at irregular intervals and their substance has been published to the service from month to month in the COAST ARTILLERY JOURNAL. Although submitted at irregular intervals and apparently without following any definite plan, the projects have actually been related. The objective of the Coast Artillery Board has been the development of sound doctrine and methods of fire control common to all calibers of fixed and mobile seacoast artillery. Moreover, the desirability of developing methods suitable for training of National Guard, Reserve and R. O. T. C. units has been given special consideration. At this time, the status of Coast Artillery Fire Control Materiel, Methods and Doctrine, is such that the Coast Artillery Board believes a review and coordination of numerous related Coast Artillery Board projects is desirable. In order to make such review and secure coordination, the Coast Artillery Board originated this project, *Seacoast Artillery Firing.*

DISCUSSION

2. A comprehensive study of Coast Artillery Firing involves consideration of the following subjects:

	Paragraph
Missions of Seacoast Artillery	3
Characteristics of Targets	4
The Time Element in Relation to Hitting	5
Classification of Seacoast Artillery	6
Antiaircraft Artillery as Seacoast Artillery	7
Effect of Fire	8
Development of Seacoast Artillery Fire Control Systems	9

3. *Missions of Seacoast Artillery.*—*a.* Official statements of the missions of seacoast artillery are given in War Plans Division Document No. 1, *A Positive System of Coast Defense,* and in paragraph 15, T. R. 10-5, *Doctrines, Principles and Methods, Basic.* Briefly these missions are:

(1) To prevent bombardment of important strategic points, such as large centers of population, important centers of manufacture and commerce, Navy Yards, coaling stations, docks, locks, and dams.

(2) To defeat a direct attack of hostile naval forces.

(3) To deny the enemy the entrance or occupation of harbors or other water areas which he might use as a base for land or naval operations, or both.

(4) To keep the enemy at such distance from the entrance to a water-way that friendly naval vessels may debouch therefrom and take up battle formation with the least hostile interference.

(5) To prevent the enemy from damaging or removing obstructions placed to deny him entrance to a water-way.

(6) To prevent the enemy from making a landing.

(7) To fire against suitable targets offered by enemy forces on land.

b. For the accomplishment of the above missions it is evident that seacoast artillery must be able to fire effectively against all enemy naval craft, including transports attempting to land troops, against personnel in small boats in the process of landing, against a landed enemy force, and against suitable targets in land warfare. Generally, the primary use for seacoast artillery is to deliver effective fire on moving naval targets. In fact, T. R. 10-5, *Doctrines, Principles and Methods,* assigns the Coast Artillery the independent role of keeping the area within reach of its guns clear of hostile vessels and of preventing a runby. The primary weapons for this purpose are the cannon and the submarine mine. The cannon must be of high power, mounted on a carriage of sufficient traverse to permit following a rapidly moving target, and it must be provided with a fire control system designed to furnish accurate firing data for moving targets. While the primary, as well as the most probable, role of seacoast artillery is to fire on naval targets, nevertheless seacoast artillery is assigned an auxiliary role in land defense of coastal areas, and also an auxiliary role in land warfare.

c. Seacoast artillery must be able to accomplish its missions in the following situations:

(1) Coast defense in which seacoast artillery may be operated from permanent or selected positions within the limits of permanent fortifications. This phase of coast defense is frequently referred to as harbor defense. Fixed seacoast artillery will use the standard fire control system of the forts. Mobile seacoast artillery may, in emergencies, use the standard or emergency position finding systems and communications of the forts, but as a rule it will establish a separate fire control system.

(2) Coast defense in which mobile seacoast artillery may be operated in areas contiguous to coast artillery forts under conditions necessitating a fire control system, together with communications, which is independent of those of the nearby forts, but may be interconnected with the systems of the forts.

(3) Coast defense in which mobile seacoast artillery, with its own fire control system, may be used to convert unfortified areas into temporarily fortified areas for the defense of open beaches and harbors against landings in force covered by hostile naval vessels.

(4) Coast defense in which mobile seacoast artillery, with its own fire control system, may be used in unfortified areas to defend coastal cities against harassing naval attacks.

(5) Landward defense of seacoast fortifications.

(6) Land operations with field armies when seacoast artillery can be used against targets suitable for the power of this class of artillery.

d. It is necessary to consider all the conditions under which seacoast artillery must operate in accomplishing its missions, since all the conditions have a direct bearing on a seacoast artillery fire control system, and on the preparation and adjustment of fire.

(1) The effectiveness of mobile seacoast artillery operating under the conditions [3*c* (6)] of land warfare requires little comment. Its accomplishments in the World War are generally appreciated. Moreover, it was then demonstrated that seacoast artillery units thoroughly trained for fire at moving naval targets could qualify quickly for effective fire in land warfare. For fire at naval targets, computing devices are essential. Seacoast artillery units are equipped with these devices, and trained in their use. These devices are applicable to land firing.

(2) The above comments also are applicable to the role of seacoast artillery [3*c* (5)] in landward defense of seacoast fortifications. There is no doubt of the potential effectiveness of properly trained and equipped seacoast artillery in the landward defense of seacoast fortifications. However, it is questionable whether Coast Artillerymen fully realize the necessity in time of peace for making those necessary preparations for landward defense that will insure the maximum effectiveness from seacoast artillery. The fire control equipment suitable for fire on naval targets is suitable for use in the landward defense of seacoast fortifications. Commanders in time of peace should obtain and record firing data for possible land targets, secure maps of adjacent areas, and perform necessary orientation work. Such preparations, some of which could not be made in the field, will insure advantages to the defense not to be expected in a war of movement. Assuming an adequate system of fire control for fire on naval targets, the war time effective-

ness of seacoast artillery in landward defense of coast fortifications will be measured by the foresight and initiative of Coast Artillery commanders in making comprehensive preparations in time of peace.

(3) In conjunction with the Air Service and the Navy, fixed and mobile seacoast artillery and the submarine mine should be quite sufficient to repel hostile naval attacks on permanent fortifications [3*c* (1) above]. Here we have shore guns and mines against guns on ships. Guns in temporary or permanent fortifications are practically invulnerable when compared to guns on ships. Naval authorities accept this condition as a fact, and history justifies the acceptance. * * *

(4) The foregoing discussion of the defense that fixed and mobile seacoast artillery provides for fortified harbors leads to consideration of the importance and effectiveness of *mobile* seacoast artillery in *all* coast defense operations. * * * Mobile seacoast artillery may be emplaced in fortified or unfortified areas. In either case it can be given substantially the effective fire control provided for fixed artillery. Mobile seacoast artillery may be emplaced in otherwise unfortified areas to protect beaches and harbors against the action of hostile naval vessels covering landings in force [3*c* (3) above], and to protect coastal cities from harassing naval attacks [3*c* (4) above]. Mobile seacoast artillery emplaced in permanent harbor defenses [3*c* (1) above], or in areas contiguous thereto [3*c* (2) above], supplements the permanently emplaced armament. It thereby increases the effectiveness of the permanent fortifications. When emplaced in an otherwise unfortified area, mobile seacoast artillery converts that area into a temporarily fortified area whose role is similar to that of a permanent seacoast fortification. Mobile seacoast artillery is as important in the defense from naval attack of temporarily fortified points as fixed and mobile seacoast artillery is in the defense of a permanently fortified harbor.

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4. *Characteristics of Targets*. *a*. Since the primary mission of seacoast artillery is to destroy or drive away by its fire hostile naval vessels, it is pertinent, in a study of Coast Artillery firing, to discuss the characteristics of such naval targets. Naval vessels may be classified as capital and non-capital ships and submarines.

(1) Capital ships are those provided with high-power armament and heavy armor. They vary in length from 350 to 850 feet, and in width at beams from 70 to 100 feet. Maximum speeds vary from 18 to 35 knots per hour, that is, from 600 to 1200 yards per minute. Their armor is from 9 to 12 inches, and in a few cases as much as 14 inches, on the vertical surface protecting the vital parts of the ship. Their deck protection consists of from 2 to 7.5 inches of armor arranged in three or more decks, and in future ships this may be materially increased.

(2) The primary armament of the latest capital ships consists of from eight to twelve guns of calibers varying from 16 to 12 inches, and the secondary armament of from sixteen to twenty-four guns of calibers varying from 7 to 5.5 inches. All modern capital ships have special protection against torpedoes and mines and carry antiaircraft guns. The ranges of the primary armament are not in excess of 34,000 yards, and the maximum range of most secondary armament is approximately 15,000 yards. On a few ships second-

ary armament is mounted to fire at high elevations giving maximum ranges of approximately 18,500 yards.

(3) Non-capital ships are of the greatest variety The greater number of such ships have little or no armor, and, except for light cruisers and destroyers, have speeds of less than twenty-five knots per hour. Non-capital ships may be divided into armored and unarmored ships. Armored cruisers may have from six to nine inches of armor. The armored non-capital ships may have armament that includes 10-inch guns and a relatively large number of smaller guns, including antiaircraft guns. The recent Washington Treaty limiting the number of capital ships has led to the construction of a number of cruisers of about 10,000 tons with about three inches of armor, carrying about six 8-inch guns and having a speed of about thirty knots. Destroyers are usually unarmored and usually carry four 4-inch or 5-inch guns, also one or two antiaircraft guns. Their speed is thirty-five knots or greater. Some new light cruisers have 6-inch guns with about 18,500 yards maximum range, while the 10,000-ton cruisers, carrying 8-inch guns, will have maximum ranges of approximately 27,000 yards. Their speed is thirty-five knots or greater. The maximum range of 5- and 6-inch naval guns, regardless of their ship mountings at 44° elevation, is about 22,600 and 26,600 yards, respectively. However, the maximum range of guns mounted on most non-capital ships is limited, either by the type of gun or mount or by facilities for observation, to effective ranges of about 15,000 yards.

(4) Submarines of the latest types have a speed of approximately twenty knots per hour on the surface and of twelve knots per hour submerged. They are of large size and have a cruising radius of from 3000 to 5000 miles. They mount one or two guns as large as 6 inches in caliber. Greater size and speed, larger guns, and probably some armor protection are to be expected in future designs.

b. Naval craft may endeavor to destroy or silence the shore guns by gun fire. At the same time, the ships will strive to protect themselves by their speed and maneuvering ability, and by rendering observation and fire from shore guns difficult because of the smoke screens which the hostile ships or airplanes lay down. While a smoke screen interferes with and decreases the effectiveness of fire from seacoast guns, it generally will not completely interfere with such fire. The smoke screen also interferes with the firing of the ships. Usually the personnel on shore will be able to see parts of the ships protected by a smoke screen sufficiently well to permit range and position finding, though observation of impacts may be impossible. The leading elements of the agencies creating the smoke screen will be visible from shore and will be an inviting target for seacoast or antiaircraft guns within the limits of their range. If ships have sufficient visibility to justify firing, the shore guns also may be expected to have a visibility which will justify firing. In view of the effectiveness of fire from seacoast artillery and the vulnerability of ships, the shore guns should be able to maintain superior destructive fire. In any case the submarine mine is an effective means of the coast defenses for prohibiting a runby of hostile ships under cover of a smoke screen. It is believed that naval authorities realize that the greatest protection for ships exposed to attack of seacoast guns lies in the ships' mobility, that is, in their speed and maneuvering ability. In other words, it appears that the best protection for naval craft attacking coast defenses is to expose themselves to the fire of seacoast guns a minimum of time. Since maximum speeds

vary from 600 yards to 1200 yards per minute, it is evident that hostile ships may be expected to be exposed to fire but a few minutes at a time. For example, the 155-mm. G. P. F. has a traverse of sixty degrees, so that a destroyer traveling at thirty-five miles per hour at a range of 10,000 yards can cross the field of fire in ten minutes; at 5000 yards it can cross in five minutes.

5. *The Time Element in Relation to Hitting.* *a.* From the foregoing discussion it is quite evident that to accomplish its mission seacoast artillery must be able to open effective fire in a minimum of time and to secure a maximum of hits per period, that is, hits per gun per minute, during any short period the target may be exposed to fire. Time and accuracy are the elements which control in the case of effective fire on moving naval targets. The short time the moving target may be exposed to fire dictates that accuracy of fire be maintained with a minimum of reduction of the possible rate of fire.

b. Our Coast Defense Fire Control System makes possible the delivery of effective fire on ships, but to obtain this result battery commanders must use properly the tools with which they are provided. Coast Artillery fire control apparatus is acceptably accurate, but painstaking care is necessary in its operation. The ideal seacoast artillery fire control system should furnish accurate ballistic data to a cannon as rapidly as that cannon can be served, laid, and fired. Our present fire control system closely approximates this ideal, so that a high rate of fire should not decrease the accuracy of fire. However, in the practical application of the system the number of shots that will be fired in a given time will depend largely on the manner of conducting and regulating fire.

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8. *Effect of Fire.* *a.* The naval engagements of the Russo-Japanese War indicated that it was not then necessary to explode shells in the vital parts of a ship to put the ship out of action. The racking effect due to the detonation of high explosive shells will probably open up the ship's seams, derange machinery, cause casualties to personnel and affect the morale to a considerable extent. The aim in our service is to explode projectiles in the vitals of a ship. Naval battles in the World War showed that a few such hits will damage ships sufficiently to drive them from action. In the battle of Jutland, capital ships withstood an average of twelve hits without being completely disabled. No empirical rules can be laid down as to the number of hits required to destroy or disable a ship. The number of hits assumed to give a reasonable probability of destruction can be but a rough approximation. In past studies, the Coast Artillery Board assumed five hits from primary armament to be required with projectiles of latest design to put a capital ship out of action or sink it. On the other hand, the Naval War College assumes from eleven to twenty hits with 14-inch projectiles as the number required to destroy or materially damage capital ships. Considering the power of our seacoast artillery primary armament and the design of projectiles in connection with the lessons of the naval engagements of the World War, it would appear that ten hits is a fair approximation to put a capital ship out of action or to sink it, and that one or two such hits *may* put any noncapital ship out of action. Guns of approximately 6-inch caliber will attack a variety of non-capital ships but, as a rough approximation, it may be assumed that to damage badly or to sink one of the destroyer class, six hits will be required, while for other suitable but larger targets twelve hits will be required.

b. The United States Navy has made a theoretical investigation of the subject of accuracy of fire. Mean range errors for each of the guns were computed and an average for all of them determined. With the theoretical mean range error thus determined, a fire control error on one half of one per cent of the range was assumed. Based upon these two errors the percentage of hits was then calculated assuming a target nine feet high joining a horizontal deck one hundred and two feet wide, this target representing very closely the above-water side-armor and protective deck of the latest design capital ship. No length of target was considered, since deflection errors were disregarded. The results are given below and are very nearly correct for any guns of the Navy primary armament.

Range in yards	*Percentage of hits*
12,000	19
15,000	15
20,000	10
25,000	7
30,000	5
40,000	3

No computations are given for ranges less than 12,000 yards, but it may be assumed that, from point blank range to 12,000 yards, the percentage of hits will vary from 100% to 19%, decreasing as the range increases. We may then assume:—

Range in yards	*Percentage of hits*
5,000	66
8,000	46
10,000	32

c. No computations of the Navy for percentage of hits to be expected from secondary armament on non-capital ships are available. Assuming the field probable error of the 155-mm. GPF and a target nine feet high joining a horizontal deck thirty feet wide, which target represents very closely the vertical and deck plates of a destroyer, and disregarding deflection errors, the percentage of hits to be expected is theoretically as follows:

Range in yards	*Percentage of hits*
3,000	60
5,000	25
10,000	8
15,000	3.7
17,000	2.7

d. The above approximations of expected hits for primary armament have been determined for Naval firings, which are necessarily conducted under less favorable conditions for accuracy in fire control than exist when firing seacoast artillery. If the determined percentages are approximately correct for the Navy, we can certainly expect a better percentage of hits from seacoast artillery. For example, experience with 12-inch mortars indicates an expectancy of 50% of hits, with a minimum of 25%, at all ranges. At best such calculations are only guides. The Navy figures are assumed correct for seacoast artillery in order to be conservative in the following estimates. Based upon the above tabulated expectancy of hits, it may be assumed that to destroy or disable a ship the following number of shots from seacoast armament will be necessary:—

Range in yards	*No. of 155-mm. GPF shots to destroy or disable a destroyer*	*No. of 14-inch shots to destroy or disable a capital ship*
3,000	10	
5,000	22	15
8,000		22
10,000	75	32
12,000		53
15,000	163	67
17,000	223	
20,000		100
25,000		143
30,000		200
40,000		334

e. The accuracy life of the type 14-inch seacoast gun is estimated at from 150 to 1000 rounds; the 16-inch gun from 100 to 750 rounds; the 155-mm. GPF as high as 3000 rounds. It is probable that the number of rounds per gun available at the outbreak of hostilities will be considerably less than the number corresponding to the accuracy life.

f. Estimated numbers of shots required to insure destruction of ships have been given to emphasize the tremendous expenditure of ammunition which must be expected in long-range firing, and also to emphasize the time required for destruction when the rate of fire of the guns is considered. The figures indicate that decisive battle ranges will be within 15,000 yards—ranges for which position finding based on terrestrial visual observation is most effective. Using the same expectancy of hits for naval vessels firing on shore targets, the above figures indicate the tremendous amount of ammunition which ships must expend before they can hope for any material damage to seacoast artillery, or to the utilities it protects. It is believed that under ordinary circumstances hostile ships will not be so prodigal with the limited amount of ammunition they have and so unmindful of the life of ships' guns as to expend much effort in long range bombardment. When they do so, shore defenses may ordinarily withhold fire with reasonable confidence and rest in comparative safety. The simulated bombardment of Fort Randolph and the Charges battery during the recent Panama maneuvers called for an expenditure of ammunition which certainly would not be made by a hostile Navy under service conditions. One of the conclusions from the firing of the Navy at the seacoast artillery emplacements at Fort Morgan was "that the probability of hitting a modern emplacement at 16,000 yards under the best conditions is not greater than 10%, and that only a small percentage of these shots which hit the emplacement will do any material damage." Every coast defense engagement in the World War confirms the high degree of invulnerability of seacoast artillery to naval attack. It should be possible for seacoast artillery to fire at ranges beyond those obtained by terrestrial position finding but such firing should be carried on in a most conservative manner, and main reliance for driving away or destroying hostile naval vessels operating at extremely long ranges should be placed in the Air Service. If aircraft gains position above a target, bombing can be conducted practically as satisfactorily at 40,000 yards from shore as at 10,000 yards. The effectiveness of aircraft bombing is sufficient to deny hostile navies unmolested bombardment of our fortifications, thereby permitting seacoast artillery, when the tactical situation permits, to reserve its fire for decisive battle ranges in which its chances for destruction are considerably superior to that of the aircraft bomb. At these ranges seacoast artillery

will give positive protection to the utilities in rear. For long ranges, that is, ranges beyond the limits of satisfactory terrestrial observation, seacoast artillery should be used in conjunction with the air service, and the firing conducted at extreme ranges, in the exceptional cases that the tactical situation demands it, by methods which will sometimes be independent of the terrestrial visual position finding system. This may be necessary at decisive battle ranges when visibility is poor or effective hostile smoke screens are laid down.

9. DEVELOPMENT OF SEACOAST ARTILLERY FIRE CONTROL SYSTEM. *a.* The convictions of the Coast Artillery Board on matters of seacoast artillery fire control have been influenced by the principles involved in past development of the fire control system. Prior to 1901 there was no generally accepted system of fire control throughout the Coast Artillery service. Firing was at fixed targets. The range was determined by the ordinary long horizontal-base system, and ballistic range corrections were applied at the gun (not in the plotting room). In the Annual Instruction Order of 1899-1900 there was a clause which read in effect as follows. "When a company shall have become proficient in fire at fixed targets it may be permitted to fire at moving targets." Captain Erasmus M. Weaver, later Major General, Chief of Coast Artillery, was at that time in command of Battery G, 1st Artillery. He applied for permission to fire his annual battery target-practice ammunition at moving targets. Permission was granted and the firing took place. This practice developed that it was impossible to fire more frequently than once in three minutes because the method of fire control contemplated that the range of the target should be determined independently and separately for each round. That is, after the actual range determined specifically for each round was received from the plotting room, then the ballistic corrections necessary to apply to the actual range were computed at the gun before the gun could be set for range. As a result, it was found that the gun was loaded and ready to fire before the ballistically corrected range was available for the range setter. He had to wait from two to three minutes before the computed range could be set on the gun. It was considered essential to prevent this loss of time so that steps were taken to develop a system of fire control which would enable the range setter always to have the corrected range available when the gun was loaded. The principle laid down was that "a loaded gun should not be held up an instant for lack of corrected range for setting the range scale." The Coast Artillery Board subscribes to this same principle today. It will be shown that the present-day fire control system, properly used, applies this principle. However, in the present-day conduct of fire the principle is quite generally violated by delaying the fire of a loaded gun for the application of a range correction based upon a round-to-round deliberate adjustment of fire. The Coast Artillery Board believes the present-day violation of this basic principle, caused by the manner of regulating fire, is as fallacious as was the violation when it was due to the failure to have ballistic data at all times available for a loaded gun. Furthermore, it is believed that the present-day violation can and should be eliminated by means which will hereinafter be indicated.

b. Beginning about 1901 Coast Artillery officers concentrated their efforts on the development of a fire control system which would make corrected ranges always available at the guns. In 1902 and 1903, a Board of Officers consisting of Colonel J. P. Story, Major J. A. Lundeen, Major Garland Whistler, Captain Erasmus N. Weaver, and Captain G. T. Bartlett, was assembled to prepare a uniform system of drill regulations. After a long and careful study of the sub-

ject, the Board submitted a provisional set of drill regulations in 1906. The basic features were:

(1) Having the range and deflection corrections made immediately in connection with the plotting-room work.

(2) Firing at a predicted point and sending the corrected range of a set-forward point from the plotting room to the guns, thus accomplishing the object of having the corrected range always available for the range setter. The 1906 drill regulations were superceded by those of 1909 which continued the system of predicted firing and contained rather complete instructions in regard to fire control. The plotting board was used for plotting the course of the target at 15-second observing intervals. Predictions were made on a range correction board, the ballistic correction determined on the range board was applied to the gun arm of the plotting board, and a corrected range was determined on the plotting board. A time-range relation was provided for, but there appears to have been a more or less general failure to appreciate the importance of this time-range relation in a system of fire based upon the sound principle that a loaded gun, at all times, should have corrected ranges available. The method of predictions increased inaccuracy and the time-range board or similar device for determining the time-range relation drifted generally into disuse. Up to this time firing was at comparatively short ranges, and while there was some attention given to correction of fire (for range) from observation, the results were not too encouraging. The system of range spotting similar to that used by the Navy proved unreliable, little attention was given to corrections based upon the instrumental observation, and consequently main reliance was placed on ballistic firing. Corrections for range based upon observation of fire were not, at this time, prohibited, but they were not generally made. Deflection corrections for both guns and mortars based upon instrumental observation were generally made.

c. In 1912, when General Weaver became Chief of Coast Artillery, the 1909 regulations were in force. With a view to improving the 1909 fire control methods, certain changes were ordered from which resulted the 1914 drill regulations. These regulations provided for a 30-second observing interval instead of a 15-second observing interval. The 1909 regulation in reference to the time-range relation was rigidly enforced and the time-range board at the emplacement prescribed for use. Predictions were made on the plotting board, a corrected range being obtained from the range correction board. The method of fire contemplated trial shots and application of resulting corrections as muzzle velocity corrections, after which (except in the case of mortar fire) no corrections were permitted to be made from observation of impacts. The 1914 drill regulations were much criticized because correction of fire was prohibited, because of the time-range board, the 30-second observing interval, and the fact that predictions were made on the plotting board. As a result, in 1915, a Board of Officers was appointed to meet at Fort Totten, N. Y., to study the 1914 system and recommend changes if found necessary. Previous to the meeting of the Board the keeping of the time-range relation in the plotting room was authorized. The following conclusions of the Fort Totten Board are quoted:

(1) The Board is of the opinion that the present system of fire control described in Drill Regulations for Coast Artillery, 1914, as amended by Changes No. 1, and amended as recommended below, will insure efficient fire control instruction of Coast Artillery troops, that is, it is sound

in principle, and that it should be adhered to in principle until by actual test a better system is shown to exist.

The Board considers that in many places the present fire control installations are extremely vulnerable to an enemy's attack, and that immediate steps should be taken to provide a remedy. It further believes that plotting rooms should be placed in protected positions, perferably at the battery, and that multiple base lines should be provided as soon as a plotting board can be devised which will admit of ready change from one to another.

(2) The Board is of the opinion that the following paragraph, in substance, should be added to the Drill Regulations for Coast Artillery, 1914:

"Whenever during the firing of seacoast guns and mortars, instrumental observation from shore stations or from air or water craft shows that the use of ballistic methods has failed to place the center of impact near the target, adjustment of fire based on such instrumental observations is authorized."

(3) The Board is further of the opinion that the following sentence, in substance, should be added to Paragraph 80, Drill Regulations for Coast Artillery, 1914:

"When a target is first assigned, additional observations may be taken between bells, in order to reduce to a minimum the time necessary to furnish data to the emplacements for opening fire."

In making the foregoing recommendations the Board is actuated by the belief that by lessening the observing interval, a certain part of the time now lost in changing targets may be saved. There are, however, other elements at work to cause loss of time, which elements are believed to be common to both the system and the 1914 system. It will require an actual trial to determine how important a part of the total loss can be saved by the change proposed.

The recommendation as to adjustment or fire based upon instrumental observation was approved. However, the methods of using the data so determined remained generally crude, and they are not yet above criticism in their application to moving target firing.

d. From 1915 until after the War, Coast Artillery fire control was changed but little. Meantime, the range and power of guns greatly increased, aerial observation became an accomplished fact, and methods of measuring atmospheric conditions aloft made possible more accurate determination of ballistic firing data, with the possibility of applying to mortars the methods of ballistic fire previously possible only with guns. The World War in which so many Coast Artillery officers had considerable experience in land warfare, influenced them to neglect their ballistics in seacoast artillery firing and to apply Field Artillery methods of adjustment to the more difficult problem of fire at moving targets in water areas. Extremely long-range firing and an unwarranted desire for concentration of fire influenced all projected Coast Artillery fire control development so that up to 1922 it appeared that some Coast Artillery officers conceived that the fundamentals of the 1915 system of fire control should be discarded. About the only development of the 1915 system was the 110-degree plotting board, which makes possible some interchangeability of base lines when orientation data is known at the time of construction of the plotting boards.

e. During the post-war period, too much attention was given to adjustment of fire by observation, and too little attention to ballistic preparation of fire. The Coast Artillery Board believed that the main role of seacoast artillery still was within the limits of terrestrial observation and that a fire control system based thereon was sound. The assignment to the Coast Artillery of high-power mobile artillery, both railway and tractor, necessitated a fire control system suitable for mobile seacoast artillery. None had been developed and the ideas of most officers assigned to mobile coast artillery units seemed to be based on an understanding that the primary mission of such mobile units was fire on fixed land targets in land warfare. In 1922, the ideas of the Coast Artillery Board perhaps were reactionary as compared to prevailing Coast Artillery opinion. The basic principles which have guided the Coast Artillery Board in recent fire control development are therefore summarized as follows.

(1) The primary mission of all seacoast artillery units is destruction of naval targets.

(2) Seacoast artillery is practically invulnerable to attack by naval craft.

(3) The main role of seacoast artillery will be accomplished within the limits of terrestrial observation, that is, at ranges less than 25,000 yards.

(4) Decisive battle ranges are within 15,000 yards.

(5) The best protection ships have against shore guns is to expose themselves to fire a minimum time.

(6) Hits per gun per minute during any short period the target is exposed to fire is the object of all seacoast artillery, and therefore this object should be emphasized in instruction and training.

(7) Ballistically prepared firing data is essential and should be accurate enough to rely upon when adjustment of fire through observation of impacts is not possible.

(8) Ballistically prepared firing data will not always place the center of impact on a target and keep it there, so that means for adjustment of fire based upon instrumental observation, including aerial observation, should be provided.

(9) When a tactical situation demands the fire of a gun, the fire of that gun should not be held up an instant for lack of data, whether due to ballistic computation or because of application of corrections based upon observation of previous shots.

(10) The tactical principles involved may call for fire varying from concentrated fire on a single target to fire directed on several targets. The position finding and fire control system should permit distribution of fire sufficient to meet any probable tactical situation but should not hinder concentration when advisable. * * *

(11) Each battery normally should have position finding installation for its usual field of fire and fire control equipment. The system should be such as to permit furnishing position finding or firing data to the batteries and to utilize position finding or firing data received from other batteries or position finding data received from a central station (Group or Battalion).

(12) Each fort and group of fixed seacoast artillery and each battalion of mobile seacoast artillery should have position finding equipment.

The fort and regimental position finding equipment is primarily for the purpose of furnishing basic data in emergencies to battery units.

(13) Since the peace time mission of regular Coast Artillery is largely one of training National Guard, Reserve and R. O. T. C. units, the system of fire control should be such that the fundamentals thereof are suitable for training such units at their home stations in the application of principles and in the use of devices to be encountered in service.

(14) So far as possible the fire control system should be applicable to all classes of seacoast artillery guns and mortars, both fixed and mobile, thereby making for uniformity of devices, methods of fire control, and training.

(15) So far as may be practicable, any system of fire control adopted for short and medium-range firing should be based on principles which can be applied to long-range firing.

(16) The fundamentals of the seacoast artillery fire control system should be applicable to fixed target firing so that officers and units will be prepared and equipped to perform their secondary missions of fire at fixed targets in land warfare.

f. Having in mind the above basic principles, the Coast Artillery Board believed that the 1915 fire control system was suitable as a basis for developing a system of fire control applicable to post-war conditions. Therefore, the Coast Artillery Board considered very carefully the recommendations of the Board of Officers appointed in 1915, given in paragraph 9 *c* above.

10. *Manual Plotting Board.* *a.* The 1915 Fire Control Board recommended that "multiple base lines be provided as soon as the plotting board can be devised which will admit of ready change from one base line to another." A plotting board which would admit of ready change from one base line to another was essential for mobile seacoast artillery. Neither the Whistler-Hearn nor the 110-degree board have the necessary flexibility. In Coast Artillery Board Project No. 74, the Cloke Plotting and Relocating Board was recommended for adoption. It permits ready change from one base line to another. The Universal platen of the Cloke Board gives all the flexibility necessary for either fixed or mobile artillery. In addition to the universal platen, a specially prepared platen may be used in connection with fixed artillery which is a means of obtaining, without the necessity of reorientation, the flexibility necessary to utilize all available base-end stations. One of these boards made from a Whistler-Hearn plotting board has been given a thorough service test at Fort Monroe. It proved very satisfactory. It is simple to operate, has but two arms, primary and secondary, and has a single continuous azimuth circle. The confusion and interference caused by arms, couplers, reading windows, and azimuth circles on the 110-degree and Whistler-Hearn Boards is eliminated. Besides possessing the necessary flexibility for use with either fixed or mobile seacoast artillery it posseses the accuracy and speed necessary to obtain firing data. It may be used as a relocating board. This board permits any battery to make use of data fur-

nished by any base line which can make observations and transmit readings. The Cloke Plotting Board is suitable for both fixed and mobile seacoast artillery. These boards are now being issued to the service.

b. The Coast Artillery Board believes that the manual plotting board in connection with terrestrial observing stations is an acceptable device for the solution of the position finding problem for seacoast artillery within the maximum limits of visibility from shore stations; furthermore, that such a system gives the necessary grounding in fundamentals of fire control for all seacoast artillery firing. The Coast Artillery Board believes that National Guard, Reserve and R. O. T. C. training should be based primarily on fire control methods using terrestrial observation and manual plotting boards.

c. Assuming flexibility of communications, the position finding system at fixed batteries could be improved by issue of Cloke Plotting and Relocating Boards in place of the types of plotting boards now being used. Nevertheless, the Coast Artillery Board realizes, that the expense involved will probably limit the installation of Cloke Boards at fixed batteries to replacement purposes and to new armament.

d. It may be that a satisfactory substitute for the manual plotting board will ultimately be developed. The coincidence target computer is still under development and may give an acceptable solution of the range triangle. The coincidence target computer reported on in Coast Artillery Board Project Nos. 8 and 9 was objectionably slow. The instrument is now in the hands of the Ordnance Department and investigation is being made with a view to improving it. It should be noted that any computing device which eliminates the plotting board will thereby eliminate the graph of the target's course, which graph, as pointed out in paragraph 15, Prediction, is most valuable in moving target firing.

11. *Communications for Seacoast Artillery.* *a.* The Cloke Plotting and Relocating Board furnishes a means for ready change from one base line to another provided multiple base lines are available and the communication system permits their use. With our present fixed seacoast artillery fire control installations, the first step in taking advantage of the flexible plotting board must be taken at the fire control switchboard. The general system of having many primary and secondary observing stations grouped on the same cable is an evident weakness in fire control installations, but the practice is justified on the grounds of economy and the probability that this cable will be supplemented by others when war is imminent. No satisfactory means is provided in the present standard communication system whereby reassignment of base end stations can be made to meet the conditions in action, when it is probable that permanent installations will be injured by hostile fire. To insure that a continuous plot of a vessel's track can be made and fire efficiently maintained, it is necessary to make provisions for obtaining data from base-end stations which remain in service and are observing on the same target and for utilizing such data by a battery or plotting room which is crippled by the unserviceability of its assigned observing stations. It has been demonstrated that the communication system now used at fixed batteries can be utilized to give the flexibility desired. The

following quotation of the Commanding Officer, Coast Defenses of Puget Sound, is pertinent:

> Major Louis B. Bender, Signal Corps, who is now a member of the Coast Artillery Board, was Coast Defense Engineer here in 1916-1917, He recommended a modification of existing fire control switchboards which consisted of adding two panels to each, using commercial telephone material which could be bought locally. At the time he estimated the coast of this modification at $500 per fort, and claimed that this modification would give such flexibility to the communications that full advantage could be taken of the flexibility of the Cloke Board and any combination of stations thrown in on any battery or plotting room.

b. That flexibility of communications can be obtained is evident. The target practice report of Battery Worth at Fort Casey for the year 1919 shows that base-end stations were interchanged at will without reorientation of the plotting board, and that a continuous plot of the target's track was maintained during the practice. A Cloke plotting board was used. Flexibility of communications was obtained by means of a temporary modification of the switchboard panels.

c. Fire control switchboards installed prior to 1910 made possible the interchange of base lines within the fire command. However, after extensive use of the so-called distributing switchboard (type in use prior to 1910), it was decided that the advantages to be gained by being able to transpose lines of communication of various base lines did not compensate for the complication and ex pense involved. The distributing switchboard was superceded therefore by a switchboard which does not provide a ready means for interchange of base lines.

d. In at least one particular installation since 1910, to wit, the mortar fire command at Fort Mills, P. I., provision has been made for an immediate transposition from one base line to another. Such installations, however, are not general. In those cases where use is made of them they are designed to meet the peculiar needs of a particular situation. In view of the availability of the Cloke Plotting Board it is believed that the principle of flexibility in communications should not be limited to the fire command but should be extended to the entire fort command communication system. Furthermore, in the event of an attack on any of our fixed batteries, it may be expected that mobile artillery will be called upon to supplement the fixed armament. * * *

e. In an effort to secure the maximum flexibility in a communication sustem, the Coast Artillery Board submitted Coast Artillery Board Project No. 111, *Fire Control Telephone systems for Fixed and Mobile Artillery.* The following is a summation of the Coast Artillery Boards' conclusions:

(1) The following commanders should be provided with base lines and communications pertaining thereto under their respective separate tactical and physical control:

(a) Each battery commander,

(b) Each group or battalion commander.

(2) The communication system should permit any two suitable observing stations within a fort being used as a base line.

(3) Provisions should be made so that any battery can obtain data from any base line, within the fort that covers its field of fire.

(4) When acting independently, mobile seacoast artillery will establish forts, groups, and batteries corresponding in organization to those of the fixed batteries. When acting in conjunction with the fixed batteries they will usually establish only groups and batteries and rarely forts. Their communication system conforms tactically to that of the fixed batteries.

(5) The present coast artillery communication system does not meet the needs of the fixed and mobile coast artillery as outlined above and is below commercial standards in the matter of communication efficiency, thus rendering it unsuitable for long-range armament.

(6) The present installations should be revised to conform, as far as practicable, with the conditions of service outlined above, and should be replaced by efficient modern equipment when and where this is financially practicable.

f. The Coast Artillery Board recommended that the Signal Corps be called upon to design and submit for test the essential elements of one or more sample fire control systems meeting the conditions set forth in the above resumé. In acting upon this recommendation the Chief of Coast Artillery arranged a conference between members of his office, the Chief Signal Officer's office, and the Coast Artillery Board. At this conference the following principles were agreed upon as a guide to future action:

(1) No effort should be made to improve fire control communication systems now installed as far as short-range armament is concerned.

(2) All new 16-inch armament and other long-range batteries should be provided with up-to-date fire control communication systems.

(3) An ideal fire control communication system for long-range batteries should be developed and, if possible, installed for test with a view to approval as a general type for future installations.

(4) The fire control communication system required in each specific case should be determined by a Signal Corps study, made after the locations of guns and stations had been determined by the Coast Artillery, and should conform in principle to the approved type.

g. The above discussion in reference to communications, as well as Coast Artillery Board Project No. 111, was concerned principally with fixed battery installations but contemplates the application of the same principles to mobile seacoast artillery units. Therefore, the Coast Artillery Board has prepared Coast Artillery Board Project No. 242, *Communication System for Mobile Seacoast Artillery.* It provides for interchangeability of base lines between two adjacent batteries and with the battalion base line. There appears to be no difficulty in putting this system into effect with mobile batteries since the equipment recommended is an elaboration of that at present prescribed in Tables of Basic Allowances. A study of C. A. B. Project No. 75, *Fire Control System for 155-mm. G. P. F. Guns,* in connection with Projects Nos. 200 and 242, will give a complete outline of the proposed fire control system for 155-mm. G. P. F. batteries.

12. *Time Interval System.* *a.* In connection with the development of communications for seacoast artillery, the Coast Artillery Board has devoted con-

siderable study to the Time Interval System. The time interval system is essential to a system of fire control based on terrestrial observation from two widely separated stations. The time interval apparatus must be sturdy, reliable, reasonably accurate, and suitable for transportation with mobile artillery.

b. The present standard time interval bell system is generally satisfactory at present fixed batteries, where lines are comparatively short and of low resistance. The limit of operation of one bell over one line appears to be five miles. On shorter lines two or more bells may be operated in parallel. For longer distances two or more lines per T. I. bell must be used. Owing to the great increase in range of post-war seacoast artillery, communication lines, phone to phone, will frequently be fifteen to twenty miles in length, and in some exceptional cases they may be thirty miles long. Ninety per cent of the lines will be less than six miles long from telephone to telephone. Time interval signal lines will be of corresponding length.

* * * * *

d. The 30-second observing interval is now standard for Coast Artillery. When tracking is begun and especially when targets are changed, observations oftener than each thirty seconds are frequently desirable, are practicable, and may be made at least until the graph of the target's course is sufficient to permit plotting-board predictions. Other circumstances may make desirable observations more frequently than each thirty seconds, and such observations should be permitted. The predicting interval may be thirty seconds or a multiple thereof. Such predicting intervals provide for a regular flow of data, and even though all classes of cannon may not be capable of being fired as often as the prediction is made, the plotter is enabled to form a more accurate track of the target than with a larger observing interval and to have at hand fairly fresh data as to the target's position. Plotting-board predictions made more frequently than each thirty seconds are, in general, impracticable.—*(To be Continued)*

Spark Photograph of a .30-Caliber Tracer Bullet

By PHILIP P. QUAYLE, *Bureau of Standards*

The projectile photographs presented herewith were obtained by the method described by the writer in the *Journal of the Franklin Institute* of May, 1922. The important characteristics of the method are that the bullet motion is in no way influenced by the photographing operation nor does any mechanism involved in this operation appear on the plate. Since the earlier publication the apparatus has been completely redesigned and reconstructed so that its performance is more consistent and less dependent upon weather conditions (leakage) and that greater definition is obtained.

Fig. 1 is a photograph of a tracer bullet. It appears to have been generally believed that the strong light which the tracer bullet itself emits would prevent its successful photography. Visual observation tended to confirm this belief. The successful photograph was obtained by using a rectangular tube of black paper with its axis transverse to the trajectory and coincident with the line joining the spark gap and the center of the photographic plate. By this device the plate was shielded against the tracer light before and after the bullet had tra-

versed the tube. The plate is fogged of course, but it nevertheless shows some interesting details.

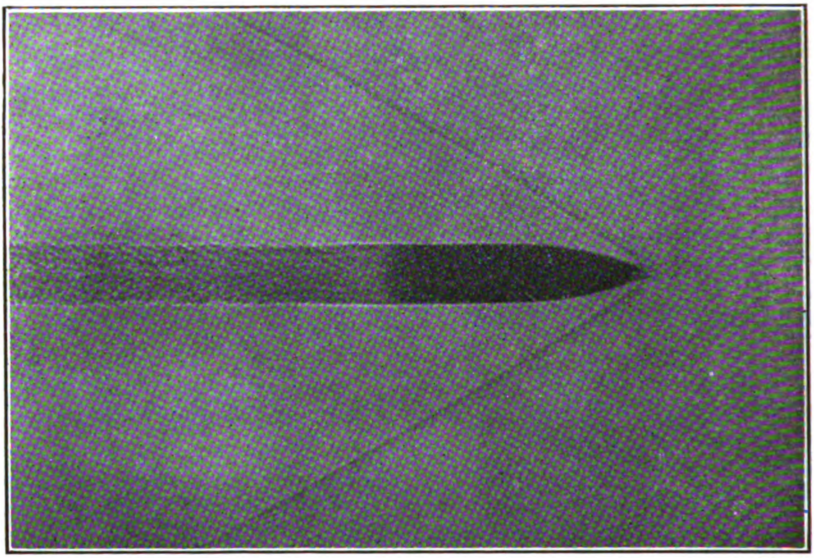

FIG. 1

The most striking thing is the almost complete absence of a tail wave (see Fig. 2). The usual tail wave is undoubtedly associated with the rapid pressure

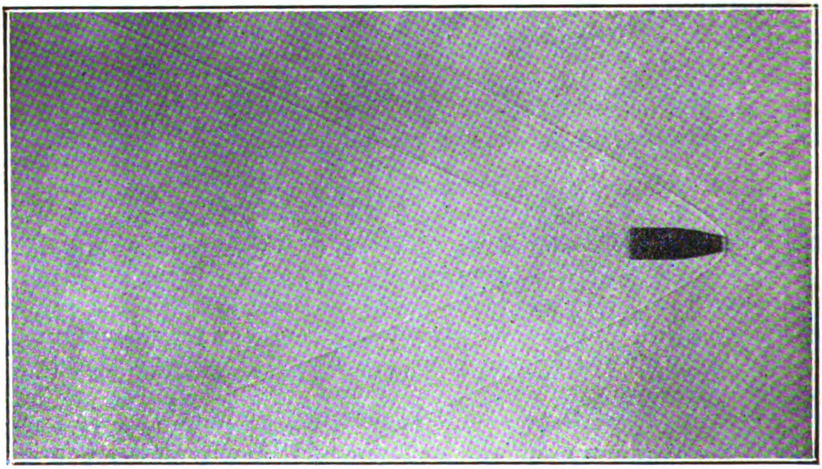

FIG. 2

change at the base which accompanies the partial vacuum behind it. Apparently the gases generated by the tracing compound prevent the formation of a region of diminished pressure, and hence the formation of a tail wave.

The second feature is the white axial line which apparently splits the nose of the bullet. This characteristic is common to all photographs which have been made with the new apparatus. Exhaustive experiments indicated that it is not due to any characteristics of the spark. To get further information on this point a portion of the nose was machined off several projectiles.

The photographs of these modified projectiles indicated that the line which apparently splits the nose of the bullet is really the apex of a very sharp wedge of light which is bent around the nose of the bullet presumably by the bow wave and falls upon the plate in the region of the bullet's shadow.

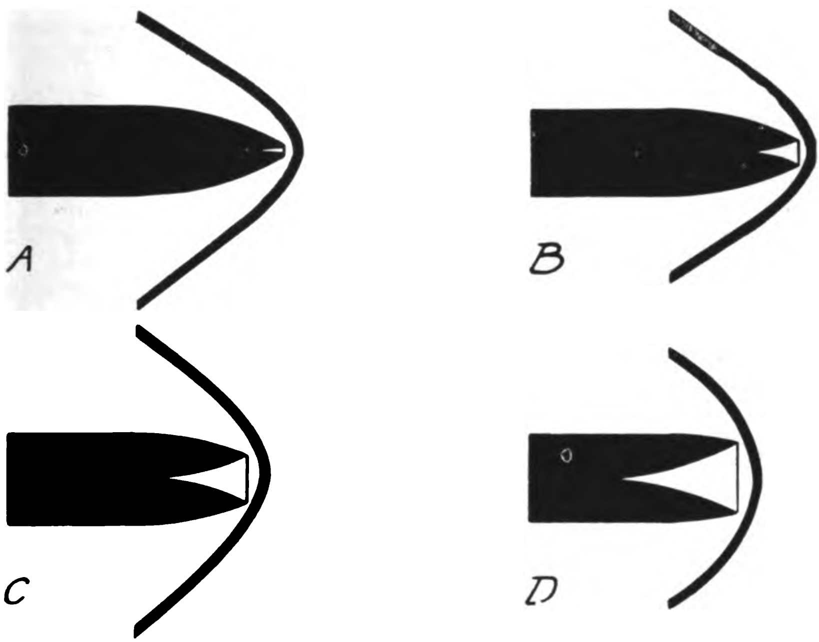

FIG. 3

Drawing indicating the progressive stages in the development of the wedge-shaped figure which occurs at the point of the projectile. "A," normal .30-caliber service bullet; "B," "C" and "D," modified forms of the service bullet. Scales: twice actual size.

The shape of this wedge varies with the curvature of the bow wave which in turn changes with the degree of bluntness of the projectile, as indicated in Fig. 3.

The mass of compressed air which a projectile pushes ahead of its nose undoubtedly contributes to the modification of the effect observed on the more pointed type of projectiles.

About two inches back from the base of the tracer bullet, particles of the tracing compound can be seen as they leave the wake.

Reserves at Fort Winfield Scott

Military activity at Ft. Winfield Scott, Calif., has been considerably enlivened recently by the presence of a number of Coast Artillery officers from the Organized Reserves, who are spending their annual 15 days of active duty at that post. The officers in attendance include those of the 627th Coast Artillery Regiment,

the 1st Battalion of the 628th, and Battery A of the 625th. The 627th is a San Francisco regiment, the 628th from Oregon and the 625th from San Diego. The Reserves have been instructed in the study of the problems incidental to the mobilization of Reserve units in the event of war as well as in a study of the various methods of fire control and fire adjustment as used in harbor defense. —*Army and Navy Journal.*

Artillery Ordnance Development

EDITOR'S NOTE: *The following notes were compiled in the office of the Chief of Coast Artillery by Captain Aaron Bradshaw, C. A. C. Credit is accorded the monthly Digest of Activities of the Ordnance Department for much of the information contained herein.*

POST-WAR DEVELOPMENT OF PROPELLANT POWDERS.—The experience gained during the World War emphasized the desirability of certain improvements in the present approved service smokeless powder for both cannon and small arms. The present service propellant for all cannon for caliber .30 rifles is so-called "pyro" powder, consisting of an ether-alcohol colloid of pyronitrocellulose in the form of relatively short cylindrical grains provided with one or more longitudinal perforations. Practically all cannon powders have seven perforations, while the caliber .30 powder is in the form of mono-perforated grains. A small amount of a stabilizer is incorporated in the colloid for the purpose of retarding the gradual decomposition, which is an inherent property of nitrocellulose and similar organic nitrates, particularly when exposed to unfavorable conditions of storage as regards heat and moisture.

Powder of this type, properly manufactured and stored under reasonable conditions in tightly sealed containers has proven highly satisfactory in many respects. There exist in the service at the present time powders manufactured over 20 years ago, prior to the adoption of a stabilizer, which are still in good condition as regards both stability and ballistics. The relatively low temperature of combustion of pyrocellulose powders reduces the erosive effect on the ggun barrels to a minimum, and the practically complete absence of smoke is a marked advantage.

The main disadvantages of pyrocellulose powders are the brilliant muzzle flash which they produce when fired, and their tendency to absorb moisture when not hermetically sealed from contact with the atmosphere. The tactical advantages which would result from elimination of the muzzle flash are apparent. Absorption of moisture by assembled charges in storage cases or in fixed ammunition causes a falling off in the velocity which the charge will produce, and in the case of bulk powder which has absorbed moisture, reblending and re-establishment of charge is necessary. Pyrocellulose service powders all contain an appreciable amount of residual solvent (ether and alcohol) which is necessarily left in the grains in the drying process during manufacture. Exposure to the atmosphere during storage of either assembled charges or bulk powder causes a gradual loss of part of this residual volatile solvent, with a consequent increase in velocity and pressure produced by a given weight of charge. Loss of solvent probably tends to leave the grains more porous, thereby increasing their tendency to absorb moisture. Both of these factors, i. e., the loss of solvent and the absorption of moisture, tend to accelerate decomposition of the nitrocellulose and thereby shorten the storage life of the powder; hence it is important that powder of this type be kept in hermetically sealed containers.

In view of these facts, the ideal propellant powders should be not only smokeless. but flashless and nonhygroscopic, and contain a minimum proportion of volatile residual solvent, or preferably a non-volatile solvent.

Attempts to produce flashless powders were made at Picatinny Arsenal several years prior to 1914, and the work was energetically pursued during 1917 and 1918. In 1919, however, a definite problem for the development of a flashless, non-hygroscopic, smokeless powder was formulated, based on the recommendations of the Westervelt Board as a result of experience gained during the war. Since that time efforts have been concentrated on obtaining powder which will combine the properties of smokelessness, flashlessness and non-hygroscopicity, together with the other essential characteristics which are required of an approved propellant, such as stability, facility of manufacture, availability of raw materials, minimum erosiveness, etc.

Muzzle flash is produced by the rapid combustion, or rather explosion, of the large volumes of combustible powder gases,—carbon monoxide, hydrogen and methane,—as they become mixed with the oxygen of the air on issuing from the muzzle of the gun, forming an explosive mixture. Their explosion may be spontaneous, due to the fact that, in spite of their sudden expansion, they are still heated above their ignition temperature, or it may be due to ignition by burning fragments of powder grains or incandescent solid particles ejected from the gun. In order to produce flashlessness it is therefore obvious that the temperature of the inflammable gas mixture be reduced below the point at which it will ignite when mixed with the air at the muzzle, and that the granulation of the powder be such that the charge is completely consumed before the projectile leaves the muzzle.

In addition to the development work which has been carried on at Picatinny Arsenal, a very large amount of similar work has been carried on by the du Pont Company, in cooperation with the Ordnance Department, on both cannon and small arms powders, and by the Hercules Powder Company on small arms powders.

75-mm. Powders.—A large proportion of the work which has been done on FNH (flashless, non-hygroscopic) smokeless powders has been confined to the 75-mm. gun for reasons of economy and convenience, it being obvious that fundamental data as to the effect of various ingredients on flash, hygroscopicity, smoke and ballistics obtained in tests with this gun would be applicable in the study of powders for other guns. Several experimental lots of powders have been manufactured for the 75-mm. Gun, Model 1897, which differed widely in both composition and form of grain, and all of which are regarded as satisfactory for this gun. Two of these have been subjected to actual service tests involving the firing of several thousand rounds. These experimental powders are being subjected to a program of periodic tests to obtain data as to their ballistic and chemical stability, and none have been found to have undergone material alteration during several years of storage. The flash produced is reduced to a dull red glow which gives no illumination of surrounding objects; the smoke is practically negligible; the hygroscopicity is no greater than that of powders with high nitroglycerin content such as Cordite; and the required service ballistics are obtained with charges which in most cases do not materially exceed the service charge of pyro-powder. It is of interest to note that the noise produced by the discharge of the gun is materially decreased when the muzzle flash is eliminated. This is to be expected, since a large part of this noise is due to the explosion of the gases which produces

the flash. It is considered that the problem of an FNH powder for the 75-mm. gun, Model 1897, has been satisfactorily solved, although there is good reason to believe that further development will lead to greater improvements.

Considerable progress has been made toward a satisfactory powder for the 75-mm. gun, Model 1920, although the much larger powder charge necessary for obtaining the higher velocity prescribed for this gun greatly increases the difficulty of eliminating the flash.

155-mm. Howitzer.—Two experimental lots of FNH powder for the 155-mm. howitzer, of widely differing composition and of different form of grain, have been manufactured, which are quite satisfactory except for the fact that they are not consistently flashless with the inner zone charges. This difficulty is to be expected, since the powder burns much more slowly under the influence of the greatly reduced pressures obtained with the reduced charges. It is believed that considerable improvements can, however, be obtained in this respect. These experimental lots are being subjected to service tests.

105-mm. Howitzr.—An entirely satisfactory FNH powder has been developed for the 105-mm. howitzer and an experimental lot manufactured for service test. This powder is of the same composition as one of the powders which has given excellent results in the 75-mm. gun.

3-inch A. A. Guns.—Preliminary results obtained with FNH powder granulated for these guns are quite promising and it is expected that satisfactory powders for this caliber will be produced during the coming year. The 3-in. A. A. gun presents a problem similar to that encountered in the 75-mm. gun, Model 1920, the high velocity, and consequent large powder charge required, increasing the difficulty of eliminating the flash.

155-mm. Gun.—Very promising results have also been obtained in this gun and greater progress is expected during the coming year. An improved powder, which although not flashless is non-hygroscopic and smokeless, has been manufactured in appreciable quantity for issue to the service. It is believed that this powder will be found to possess greater chemical and ballistic stability than pyro-powder.

Small Arms.—The work on development of FNH powders for caliber .30 and caliber .50 weapons has not as yet led to as gratifying results as have been obtained on cannon powders, but is being energetically pursued by both the Ordnance Department and private manufacturers.

3-INCH A. A. GUN MOUNTS.—The Technical Staff approved on May 21 the modification of all 3-in. A. A. Gun Mounts, Model 1917, now in service. The modifications are intended to render the mounts more easily loaded and operated. Owing to the slight difference in the design of side frames of the present mounts, the modified mounts will be differently modified. They will be known as 3-in. A. A. Gun Mounts, Model 1917 MII and MIII. The 1917 MI mount, while formerly considered a modification of the existing 1917 model, is in reality a new design.

BORE SCRAPING DEVICE.—A bore scraping device for removing copper from the bores of 3-in. A. A. guns has been developed at the Aberdeen Proving Ground. A number of these have been ordered manufactured. They will be sent to the service for test.

RAILWAY AND SEACOAST ARTILLERY.—The 75-mm. Subcaliber Gun on 12-in. B. C., Model 1917, has undergone a satisfactory test at Fort Hancock by the

Ordnance Department. After a service test by Coast Artillery personnel, its suitability as an item for issue will be determined.

DEPRESSION POSITION FINDERS.—On May 28 approval was given for the manufacture of a number of depression position finders designed for use in connection with our longest-range guns. One instrument will be completed first and tested before others are completed.

ANTIAIRCRAFT MACHINE GUN SIGHTS.—Mention was made in the April, 1925, Digest of an intensive development program undertaken that month for the design and manufacture of antiaircraft sights for calibers .30 and .50 machine guns. Work on this project has progressed to the point where a tentative design has been approved and fabrication of twenty-five antiaircraft machine gun sights is in progress. These sights, when completed, will be supplied various Coast Artillery regiments for further tests.

ATWOOD ANTIAIRCRAFT SIGHTS.—Eighteen of the twenty-six Atwood antiaircraft sights, Model 1925E, for the caliber .30 Browning machine gun have been completed and shipped to the 62d Coast Artillery Regiment, Fort Totten, N. Y. The remaining eight sights will be completed and shipped in the next two or three weeks.

MARK III SCOVILL A. A. FUZE.—Mark III Scovill type antiaircraft fuze has been approved as standard for 3-in. A. A. guns in place of the Mark II modified type, previously listed as standard. This change is the result of comparative tests made at the Aberdeen Proving Ground which indicate that the Mark III fuze is superior. The Mark III fuze is also more readily producible since it is almost identical with the 21-sec. combination fuze for mobile artillery.

The 619th Coast Artillery

By FIRST LIEUT. F. J. SINGER, *619th C. A.*

EDITOR'S NOTE: *The 619th Coast Artillery claims the distinction of being the first reserve regiment to have fired major-caliber armament as a unit. This firing took place at Fort Hancock, New Jersey, on June 24, 1925. Five service rounds were fired at a moving target from a 12-inch rifle mounted on a disappearing carriage at a range of 11,000 yards. Officers of the 619th Coast Artillery had full responsibility for the prpearation for firing, execution of the firing, and analysis of the target practice.*

On Sunday, June 14, 1925, ten reserve officers of the 619th C. A. reported at Fort Hancock, New Jersey. Lieut. Col. George O. Hubbard, C. A. C., unit executive officer, was already at the post. We, as reserve officers, were not mutually acquainted and were not certain what the next two weeks had in store. The "unit training" plan for the camp had been discussed during conferences, but we were not certain how well this plan would work out nor how much we would be able to learn from our experiences as officers in a reserve regiment assigned to active duty as a unit at a regular Coast Artillery post. All were agreed that the "unit" plan sounded very practical, and that it would be a fine experience to have command of the regular troops. Some of us, however, not having had such practical experience, did not know to what extent we would be able to fill the places of regular officers whose duties we were about to perform.

The first light on this subject was thrown our way that evening when Col. E. B. Martindale, Jr., the Camp Commander, gave us a smoker. The Colonel told us that we would have full responsibility to function as a unit, and the troops would be transferred temporarily to the 619th C. A. (the regular officers at the post being available to give instruction and advice). Those words were

very significant. They told us what our latitude would be and what was expected of us. Responsibility meant that we must work hard to succeed, and that the success of the camp depended on us, individually and collectively, as officers of the 619th C. A.

Lieut. Col. Hazeltine, who took active command, issued an order stating that the 619th C. A. would function tactically as a battalion, and assigned officers to the staff, to Headquarters battery, and to batteries A, B and D. During the period that followed, the regiment functioned administratively as a regiment but tactically as a battalion. The officers of the 619th C. A. took over the batteries and assumed the responsibilities of the 7th C. A. officers whom they relieved. The training in tactical functions was that of a group command. The administrative work was representative of that carried on in a regiment at a post. Morning reports, ration returns, guard rosters, etc., were filled out.

It was considered that the officers of the 619th C. A. carried on the training successfully. We received many helpful suggestions and good advice from Lieut. Col. Hubbard and excellent cooperation and assistance from the officers and enlisted men at the post. There was plenty of work to do and plenty of chance to get excellent practical experience of the kind that would prove most valuable to reserve officers in an emergency. There were numerous minor errors made by the reserve officers in performing the functions but in general everything went very smoothly, and at the end of camp all officers of the 619th were most enthusiastic about the results. All agreed that the "unit training" plan was much to be preferred to the "individual training" plan.

During the fifteen day period there was plenty of artillery drill on the 12-inch rifles mounted on disappearing carriages at Battery Bloomfield. This artillery drill consisted of preparation for and practice in major-caliber firing, and preparation for and practice in sub-caliber firing. During the sub-caliber practice gun No. 2 and a moving target at a range of approximately 3,000 yards were used. For the service practice, gun No. 1 was fired at a moving target at a range of approximately 11,000 yards. During the former practice approximately fifty rounds of sub-caliber were fired, and for service practice five rounds were allowed and fired. Both practices were considered successful.

In addition to the artillery practice, we commanded the troops during infantry ceremonies, inspections, and work in preparation for these. We had a few excellent lectures given by officers of the post and instruction in matters pertaining to artillery and special subjects. We had two nights of searchlight drill and, at the last drill, manned the Fort Command Station and Battery Bloomfield.

On Friday, June 26th, Battery Bloomfield was checked up and turned back. On Friday and Saturday, June 26th and 27th, an analysis of the target practice was made by officers of the 619th C. A., and at 3:00 p. m., Saturday, the critique of the practices was held, officers of the 7th C. A. being present at the critique. The balance of the time at camp was employed in clearing up odds and ends at the batteries and in writing reports on the camp. Regimental headquarters functioned at full capacity in order to complete the general reports and special details.

On Saturday evening and Sunday morning we made final calls upon officers of the post and bade them farewell. We left the post for our respective homes satisfied that the camp had been a big success, and that we had received a splendid training as reserve officers.

Remarks Concerning the Use of Firing-Table Values

By 2D LIEUT. PHILIP SCHWARTZ, O. D.

In order to be able to analyze the results of firings of service batteries satisfactorily, a knowledge of the magnitude of the errors which may occur due to making use of the quantities which are taken from the firing tables or from correction devices is of considerable value. With this in view, a table has been compiled in which the relative accuracy of each quantity has been tabulated; this table is far from *exact*, but it is probably as satisfactory as can be obtained on account of the lack of experimental evidence. It does not represent the official opinion of the Ordnance Department but was compiled by the writer as a result of his experience. The classification is as follows, where Class A = ± 1% approximately, Class B = ± 2% approximately, Class C = ± 5% approximately, Class D = ± 15% approximately, Class E = ± 30% approximately, Class F = ± 50% approximately.

	Quantity	*Class*	*Remarks*
1.	Range (based on given elevation, muzzle velocity and projectile.)	A	Firing-table value based on average of several days firings in a comparatively new gun.
2.	Effect on range of change in elevation.	B	Computed from (1).
3.	Maximum ordinate.	C	No observations; based on theoretical computation.
4.	Terminal velocity.	C	Same as (3).
5.	Angle of fall.	C	Same as (3).
6.	Drift.	B	Same as (1).
7.	Ballistic coefficient.	B	Same as (1).
8.	Probable error in range or deflection.	F	Based on several days firings, but usually only a limited number of rounds each day. This value varies from day to day, depending on gustiness of atmosphere. Varies also with gun and gun crew.
9.	Time of flight.	A	Same as (1).
10.	Angle of site effect on range.	B	Computed from ballistic tables.
11.	Projectile weight effect on range.	E	Based on interior ballistic formulas of doubtful accuracy.
12.	Rotation of earth effect on range and deflection.	C	Computed from ballistic tables.
13.	Muzzle velocity effect on range.	B	Computed from ballistic tables.
14.	Air density effect on range.	B	Computed from ballistic tables.
15.	Air temperature effect on range.	F	Computed; poor air resistance law casts doubt on this value.
16.	Wind effect on range and deflection.	C	Computed from ballistic tables. Formulas used verified recently.
17.	Cant effect on deflection.	—	As accurate as measured cant.
18.	Penetration in armor.	E	Based on empirical approximate formula.

Some other quantities which are used in connection with firing tables and correction devices can be classified as follows:

	Quantity	*Class*	*Remarks*
19.	Powder temperature effect on muzzle velocity.	F	Based on a few doubtful experiments.
20.	Seating, weight of charge, or pressure, effect on muzzle velocity.	E	Based on doubtful interior ballistic formulas.
21.	Erosion of gun, damage to projectile, deterioration of powder with age, moisture in powder, etc.	F	No reliable values.

	Quantity	*Class*	*Remarks*
22.	Jump (vertical or lateral).		Varies considerably with individual gun and carriage.
23.	Ballistic wind measurement.	D	Wind varies from moment to moment. Approximate weighting factors used.
24.	Ballistic density measurement.	D	Requires aeroplane observation of temperature. Approximate weighting factors used.
25.	Air temperature measurement.	D	Same as (24).
26.	Effect of rain and mist upon range and deflection.	—	No reliable values.

The usefulness of this table does not depend upon the accuracy of the numerical value of the percentage attached to any class. It can best be interpreted as meaning, for example, that item 1 of Class A is known about as accurately as item 9 which is in the same class; but it is more accurately known that item 2, 6, 10, 13, or 14 of Class B. Item 8, the probable error, is very inaccurate, and in using this quantity, allowance should be made for a large variation from the firing table value. Item 19, powder temperature effect on velocity, is so inaccurate that it is of considerable importance to keep the powder near its standard temperature in order to avoid large errors due to making use of such a correction. Ballistic investigations now in progress may change the above classification as new results are obtained.

At low elevations where vacuum conditions are approached, the effect of wind and atmosphere is of relatively little importance, the effects of greatest importance being those due to variations in elevation and muzzle velocity. On the other hand at high elevations, where the time of flight is long and where the air acts on the projectile for an appreciable time, the wind and atmosphere effects take on an importance equal to that of variations in the muzzle velocity, while errors in elevation have less effect on range as the elevation approaches 45°. In the case of howitzers the low velocity in use causes vacuum conditions to be approached, errors in muzzle velocity usually being of importance, whereas elevation and air density errors are of less importance. In the case of seacoast mortars, trench mortars and rifle grenades, the low velocity and the relatively heavy projectiles cause vacuum conditions to be approached even for elevations of 45° and above, and errors in velocity are the most probable cause of discrepancies, especially when firing in the lower velocity zones. For all fire above 45° at a fixed range with a given projectile, wind effects become smaller as velocity decreases.

The 544th Coast Artillery

On August 16, 1925, the 544th Coast Artillery (AA) completed its annual tour of duty at Fort Terry, N. Y. The regiment was commanded by Lieut. Col. Walter Bowen Smith, of Providence, R. I. Major Roy S. Atwood, the Executive Officer, accompanied the regiment.

Upon its arrival at camp the regiment immediately established its own headquarters, with all of the regimental staff officers and the sergeant-major functioning. This fact relieved the camp headquarters of much administrative detail and paper work. The 1st Battalion worked almost entirely on the guns, while the 2d Battalion spent its time on the machine guns. During its tour the regiment executed a tactical problem which included the selection of positions and the emplacing of guns.

MILITARY NOTES

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THE MILITARY INTELLIGENCE DIVISION, G. S.

Great Britain

TERM OF MILITARY SERVICE.—Army service in Great Britain is entirely voluntary, as it is in the United States. The term of enlistment, however, is much longer than in this country, as will be seen in the folowing table:

Corps	*With the Colors years*	*In the Reserve years*
Household Cavalry	8	4
Cavalry of the Line	7	5
Royal Horse Artillery and Royal Field Artillery	6	6
Royal Horse Artillery and Royal Field Artillery (for appointment to Royal Field Artillery only)	3	9
Royal Garrison Artillery	8	4
Royal Engineers:		
Sappers of trades shown in paragraph 7, Appendix II, Regulations for recruiting	3	9
Sappers, all others	6	6
Pioneers	6	6
Drivers	2	10
Men enlisted for appointment as military mechanists	12	Nil.
Railway Reserve	Nil.	6
Foot Guards:		
Men enlisted for appointment as bandsmen	12	Nil.
Other recruits	3	9
Infantry of the Line	7	5
Royal Garrison Artillery, Hong Kong and Singapore Battn.		
West India Regiment	12	Nil.
Army Service Corps:		
Drivers—Horse Transport	2	10
Supply	3	9
Mechanical Transport	7	5
Royal Army Medical Corps	3	9
Royal Malta Artillery	7	5
West African Regiment	6	Nil.
Army Ordnance Corps:		
Armorer and Armament Artificer Sections	12	Nil.
Other Recruits	6	6
Corps of Army Schoolmasters	12	Nil.
Royal Engineers, Hong Kong Company	5	Nil.
Royal Flying Corps, Military Wing	4	4
Boys for Royal Flying Corps, Military Wing for such period as will enable them, after attaining 18 years of age to serve	4	4
Boys for training as clerks, bandsmen, trumpeters, drummers, buglers, or pipers	9	3
Boys for training as tailors or shoemakers	12	Nil.
Boys for training as artificers, all arms other than Royal Flying Corps, Military Wing	12	Nil.

All enlistments in the Territorial Army are for four years.

The age for enlistment and reenlistment for all arms is between 18 and 38 years, except as follows:

(a) Boys between 17 and 18 years of age may enlist with the written consent of their parents.

(b) Men up to the age of 45 years may be enlisted as farriers, fitters, wheelwrights, saddlers, harness makers, cooks, bakers, transport drivers, storemen, or butchers.

(c) Men who have seen service in the Artillery, Engineers, Signal Corps or Naval Volunteer Reserve, and who have had experience in antiaircraft duties, may be enlisted in antiaircraft units up to the age of 45 years, but the number of these men should not exceed fifty per cent of the strength of the organization.

(d) Bandsmen and clerks may be enlisted up to the age of 50 years if they are physically fit for garrison duty overseas.

(e) Boys between the ages of 14 and 17 years may enlist as trumpeters, buglers or bandsmen with the written consent of their parents.

France

System of Promotion.—The present system of promotion in the French Army is interesting as it shows a successful application of the promotion of officers both by seniority and by selection.

Officers are appointed as second lieutenants from the three following sources: sources:

1. Selected noncommissioned officers recommended for commissions.
2. Graduates of the Ecole Polytechnique and Saint Cyr.
3. Noncommissioned student officers of the Saint Maixent and Versailles Schools.

Second lieutenants of all branches are promoted to first lieutenant after two years' service.

Promotion to the grade of captain and major is made partly by selection and partly by seniority. One third of the promotions to captain are by selection and the remaining two-thirds by seniority. For a major, the promotion is half and half.

The promotion of staff officers and to all grades senior to that of major is made exclusively by selection.

No officer, however, can be promoted to a higher grade until he has served the minimum number of years required by law in his grade. This minimum service requirement is, as follows:

2 years as a first or second lieutenant,
4 years as a captain,
3 years as a major,
2 years as a lieutenant colonel,
3 years as a brigadier general.

In time of war, the required service is reduced by half and, in special cases, may be entirely disregarded to reward an act of bravery cited in army orders.

The selection lists of officers of all grades are made up annually, based on the recommendations of chiefs of branches. These lists are the work of selection boards appointed for each arm and service and by a superior commission of

classification which covers all arms and services and which passes on the recommendations of the selection boards.

Infantry selection boards are appointed in each military district or army corps area. They are composed of all general officers commanding infantry units in the area and function under the supervision of the corps area commander.

The other selection boards are general and cover the whole arm or service.

The selection boards draw up the lists of officers to be promoted by selection to the grade of 1st lieutenant, captain and major. They prepare a list of officers whom they recommend be placed on the selection lists for promotion to the grades of lieutenant colonel, colonel and brigadier general.

The superior commission of classification, upon receipt of the recommendations of the area selection boards, draws up the selection lists for the promotion of officers to the ranks of lieutenant colonel and colonel. It classifies colonels and those of equal assimilated rank according to preference and arm of service. It does the same in the case of brigadier generals having less than three years service in that grade. For this classification, the members of the Superior War Council who have charge of the inspection of Army Corps, the Chief of the General Staff of the Army and the president of the selection board (the last in so far as it concerns candidates belonging to his arm) take part in the deliberations of the superior commission. The Superior War Council must give its approval of candidates, whose names are submitted to it by the Minister, for the duties of army corps commander.

The number of candidates to be inscribed on the selection lists or to be presented for each grade is fixed by the Minister before the board meets; the number of officers in each grade, however, must not exceed twice that of the number of vacancies. The number allotted to each area infantry board is determined by the Minister and is in proportion to the number of officers in the area who fulfil the conditions of length of service required for promotion. The lists established by the area boards are afterwards combined into one list for each grade. These lists, arranged by grade and by arm or service, are transmitted to the Minister and constitute the selection lists for the year. The candidates are arranged, in each grade, in order according to length of service in that grade.

Italy

The Cavalry School.—The Italian Cavalry School, called School of Application for Cavalry, is situated at Pinerolo in northwestern Italy about 25 miles southwest of Turin. Pinerolo is a picturesque medieval town of about 14,000 inhabitants.

The present school is the outgrowth of the "Military School of Equitation" which was founded in 1823 at Venaria Reale, a few miles north of Turin. In 1849 Pinerolo was selected as the site of the new school because of its excellent climate and abundant water and forage supply, in addition to the fact that Venaria Reale was to be turned over to the Artillery. Up until the time of the Franco-Prussian War instruction was given only in equitation and the use of the sabre. After 1870, in addition to the above, a general course of instruction was instituted and has been continued since that time.

In 1825, soon after the opening of the "Military School of Equitation," Otto Wagner, a German, was appointed head of the Department of Horsemanship and remained as such until 1845. Later, Cesare Paderni, an ex-Austrian officer

who had graduated at Vienna, was appointed Chief Instructor, which position be held for thirty years.

Consequently, Italian equitation was based on German and Austrian principles which were followed for many years. In 1894, however, Lieutenant Caprilli, afterwards Captain, developed his system of equitation which proved so successful that in 1902 it was adopted by the Italians. Caphilli may be called the founder of the present day school of Italian equitation which is now so well known.

At the present time the student personnel at Pinerolo is composed of those officers, who, because of the World War, have not previously been able to take the course. In fact the present object of the school is to supplement theoretically the practical knowledge acquired by these student officers during the war, and to enhance their general professional education.

The number of student officers varies from 40 to 60. No quarters are furnished student officers by the government. They rent quarters in the town.

The course at Pinerolo lasts seven months, six months for the course itself and one month for examinations. The courses are both theoretical and practical. Special lectures are delivered on geographical subjects, history and social science, and on any topics of interest that may be selected by the Commandant.

The schedule of instruction is as follows:

Military Art and Field Fortifications:—Length of course, 60 hours.
Communications—Length of course, twenty-five hours.
Department of Weapons—Length of course, forty-five hours.
Topography—Length of course, thirty hours.
Hippology—Length of course, twenty hours.
Geography, Political-Military History, Social Sciences, Physical Education (theoretical part)—Lectures. No examinations.
Motor Transport—Theoretical-practical course. No examination.
Physical Education (practical)—Length of course to be decided by the Commandant.
Hygiene and Administration and other subjects—Length of course to be decided by the Commandant.
Horsemanship—About five hours per day.

At the end of the course the officers must pass an examination.

All students must bring two private mounts in addition to three horses furnished by the school. The majority of school horses are pure bred.

It has been the policy of the Italian Government to permit officers of certain countries to attend the Cavalry School at Pinerolo. In this case the following requirements are made:

(a) The officers must have had sufficient riding experience.

(b) A sufficient knowledge of the Italian language is necessary

COAST ARTILLERY BOARD NOTES

Communications relating to the development or improvement in methods or materiel for the Coast Artillery will be welcome from any member of the Corps or of the service at large. These communications, with models or drawings of devices proposed, may be sent direct to the Coast Artillery Board, Fort Monroe, Virginia, and will receive careful consideration.—R. S. ABERNETHY, *Colonel, C. A. C., President Coast Artillery Board.*

New Projects Initiated During the Month of August

Project No. 380, Radio Equipment for Combat Troops in the Field.—A report of a board of officers convened by the Chief Signal Officer to consider a revision of radio needs for combat troops in the field was referred to the Coast Artillery Board by the Chief of Coast Artillery for remark and recommendation.

Project No. 381, Signal Corps Development Program (Communications Equipment).—The Chief Signal Officer has prepared papers giving the general status of development work undertaken or proposed and an outline of a proposed two-year development program. These papers were referred to the Coast Artillery Board by the Chief of Coast Artillery for remark and recommendation.

Project No. 382, Firing Tables for 3-inch Antiaircraft Gun, Model 1918.—Firing tables for the 3-inch AA Gun, Model 1918, firing AA shrapnel, Mark I, armed with Scovill fuze, Mark III, have been prepared by the Ordnance Department. These were referred to the Coast Artillery Board by the Chief of Coast Artillery for information as to whether or not the tables were in satisfactory form for publication. The Board is making a comprehensive study of the tables and will make recommendations with regard to an improved form for all future antiaircraft firing tables.

Project No. 383, Employment of Repeating Coils on Field Telephone Lines.—The Chief Signal Officer referred to the Chief of Coast Artillery correspondence relating to tests in connection with the employment of repeating coils on field telephone lines, asking that he be informed whether the Coast Artillery desired to participate in the proposed service trials. These papers were referred to the Coast Artillery Board for remark and recommendation. The Coast Artillery Board recommended that four modified repeating coils be furnished for tests in connection with T. I. apparatus, and also for the determination of their possible use with field wire for phantom and simplex circuits.

Project No. 384, Spare Elevating Handwheels for 14-inch Disappearing Carriage, Model 1907 MI.—The Department Ordnance Officer, Panama Ordnance Depot has recommended that the Chief of Ordnance supply additional handwheels for the 14-inch disappearing carriage, Model 1907, MI. This recommendation was made for the purpose of providing a spare elevating handwheel for use

on the left traversing crank, which will enable the azimuth setter to lay the piece in azimuth more quickly and more accurately than can be done with the traversing crank handwheel. The correspondence was referred to the Coast Artillery Board by the Chief of Coast Artillery for remark and recommendation, particular attention to be paid to the cost of these handwheels.

Project No. 385, Confidential.—Not to be published.

Project No. 386, Supple Spotting Board.—Lieutenant Edward Supple, C. A. C., has submitted to the Coast Artillery Board a description of an improved spotting board of the type considered under the heading "Rockwood Spotting Board" in Coast Artillery Board Project No. 173, COAST ARTILLERY JOURNAL, Volume LIX, Page 499. This spotting board is being studied.

Project No. 387, Firing Tables for 1-pounder Subcaliber Tube.—Complete firing tables for the 1-pounder subcaliber tube for 5-inch, 6-inch, 8-inch, 10-inch, 12-inch and 14-inch guns have been prepared by the Ordnance Department. A copy of these tables was referred to the Coast Artillery Board by the Chief of Coast Artillery for information as to whether the tables were in satisfactory form for publication. These tables were recommended as satisfactory.

Project No. 388, Experimental Work with Gas Mask at Coast Artillery Target Practice.—The Commanding General, Ninth Coast Artillery District, directed that the Commanding Officer, Harbor Defenses of San Francisco, report on the basis of the service target practice under gas at Battery Wallace recommendations concerning: (a) the suitability of the present diaphragm gags mask for the fire control section of a Coast Artillery battery, (b) the suitability of the gas mask furnished, for use with optical instruments, (c) the possibility that some of the men in the fire control section have duties such that they can not wear a gas mask, (d) the possibility that some of the men in the gun and ammunition sections have duties such that they can not wear a gas mask, (e) the effect on the rate and accuracy of firing, caused by having the battery personnel wear the latest type of gas masks. The report was referred by the Chief of Coast Artillery to the Coast Artillery Board for remark.

Project No. 389, Repeat-back System for 60-inch Mobile Searchlight Unit.—The Chief of Engineers requested that the Chief of Coast Artillery make recommendations concerning specifications and arrangement drawings covering the installation of an experimental system for the 60-inch mobile searchlight, Model 1925. The Chief of Coast Artillery referred this communication to the Coast Artillery Board and the Board concluded that the development of the equipment described was desirable.

Project No. 390, Predicting Targ Setforward Device.—Captain A. M. Jackson, Coast Artillery Corps, has designed a targ which replaces the usual standard targ and eliminates some of the steps in predicting the setforward point. A special setforward ruler is used in conjunction with this targ. The Chief of Coast Artillery directed that the Coast Artillery Board make a study of the target practice report in which these devices were used. The conclusions of the Coast Artillery Board were that neither the predicting targ nor the setforward ruler meets the requirements of fire control instruments for Coast Artillery use, but that these devices may be satisfactory in special instances.

BOOK REVIEWS

Famous American Naval Officers. By Charles Lee Lewis. L. C. Page & Co., Boston. 1924. 5½"x 8". 374 pp. Ill. $2.00.

A record of the important events in the development of the United States Navy chronicled in sketches of its most famous officers. This method of presenting such a history has many advantages, one being that it attracts and holds the interest of the reader. It also tends to mark out boldly, step by step, the development of the navy. It is written primarily for the American youth. In its pages we find a record of the achievements not only of the officers who have been outstanding in American naval battles, but also of the able officers such as Mahan and Peary, who through long periods of peace exerted a powerful influence toward developing an efficient Navy. Beginning with John Paul Jones and the American Revolution and closing with William Sowden Sims and the World War, the author presents a book particularly worth while to those who wish to get in brief and essentials of our naval development.—C. S. H.

A Year of Prophesying. By H. G. Wells. The MacMillan Company, New York. 1925. 5½"x 7¾". 352 pp. $2.00.

A new book by H. G. Wells is an event to his countless admirers. This is his twenty-ninth book and it will not lack for an audience. This is due primarily to his powers of imagination and his lucid style. *A Year of Prophesying* is a collection of fifty-five articles which appeared weekly in England. They cover many and varied subjects: our clothes, our houses, our amusements, our ways of trading, our laws, our politics, the British Empire, the American Constitution, Lenine, China, India, Fascism, France's attitude toward Germany and the League of Nations.

Each chapter is from five to eight pages and complete in itself, thus making a delightful book to have for reading at spare moments.

In the final chapter the author almost writes a review of the book. To quote him:

> I think most of the clothes ugly and dirty, most of the food bad, the houses wretched, the schools starved and feeble, the amusements dull, the monetary methods silly, our ways of trading base and wasteful, our methods of production piecemeal and wasteful, our political arrangements solemnly idiotic. Most of my activities have been to get my soul and something of my body out of the customs, outlook, boredoms, and contaminations of the current phase of life.
>
> My imagination takes refuge from the slums of today in a world like a great garden, various, orderly, lovingly cared-for, dangerous still but no longer dismal, secure from dull and base necessities. I have come

to believe in the complete possibility of such a world, and to realize the broad lines upon which we can work for its attainment through a great extension of the scientific spirit to the mental field, and through a deliberate reconstruction of social and economic life upon the framework for a new far-reaching educational organization. By projecting my mind forward to that greater civilization I do succeed in throwing a veil of unreality over the solemn ineptitude of today and the complete identification of myself and my insufficiencies and disappointments with the quality of common things. By insisting that I can be a creative revolutionary I escape from acquiescence in what I am and what things are. To live under the rule of King George or President Coolidge and under the sway of current customs, habits and usages, can be made tolerable by the recognition of their essential transitoriness and their ultimate insignificance. And in no other way can it be made tolerable to anyone with a sense of beauty and a passion for real living.—W. W. I.

Blockade and Sea Power. By Maurice Parmelee. Thomas Y. Crowell Co., New York. 1924. 5½"x 8". 449 pp. $3.00.

In this volume Mr. Parmelee presents an interesting and valuable work. His historical account is as impartial as it is authoritative, and, whether or not one agrees with his opinions concerning a World State and the conclusions he draws, one finds them original and stimulating.

In part I the author gives an impartial account of the outstanding features of the blockade of 1914-1919—its beginnings, its effects upon the German people and upon neutrals, and its final importance in the winning of the war. He discusses the violations of international law committed by both sides in conducting their blockades, and he points out that the German people regarded the starvation blockade conducted by the Allies as much an atrocity as the Allies considered unrestricted submarine warfare.

In conclusion, the author emphasizes: (1) That the general retreat of the German Army in 1918 was due largely to the lack of guns and munitions of war, which, with the supply of raw materials cut off by the blockade, could no longer be replaced when worn out or exhausted; and (2) That with half a million tons of allied and neutral shipping being sunk in a month, had the unrestricted submarine warfare of Germany not been checked when it was, Germany would have won.

In the opening chapters of Part II the author touches upon the great underlying causes, economic and imperialistic, responsible for wars and forming the great problems to be solved by any world state of the future, since they will be its excuse for existence. Only once does he desert his somewhat detached attitude, this in an impassioned harangue against the principle, "In time of peace, prepapre for war." He argues that the possession of a strong and efficient army and navy begets a temptation to use them, and puts his arguments strongly and convincingly, citing the case of Germany in the World War in refutation of the axiom that a strong defense compels peace. His statement that "the struggle for export trade was one of the principal causes of the late war," is especially provocative, and he arrives at the conclusion that a World State is the answer to these questions in a highly convincing manner.

The essential features of a World State are outlined, among them being, abolition of absolute national sovereignty, complete national disarmament to police protection strength, and abolition of all discriminatory tariffs, etc. Having outlined an ideal World State, he contrasts the present League of Nations, point by point, with other proposed schemes in a manner highly derogatory to the League

in its present form. He emphasizes the fact that the League of Nations is no true example of a World State at all, being part of a victor's treaty and designed for the victor's especial benefit, and calls it, with a pertinently expressive sarcasm, the "League of the Entente Allies."

In conclusion he admits that a capitalistic social order with its attendant, often unscrupulous, trade rivalries is probably so inimical to the success of a World State as to be an insuperable obstacle, and that, above all, be the formation of a World State ever so desirable and the opportunities never so great, as long as men are men, men will fight.—A. B. N.

The Military Side of Japanese Life. By Captain M. D. Kennedy. Houghton Mifflin Co., Boston. 1925. 6"x 8¾". 367 pp. $5.00.

This volume is described on the jacket as "***not a book of propaganda but a fascinating study of Japanese life written in a vigorous style***." The style is informal, almost naive, and chatty rather than vigorous. The book is sometimes interesting, sometimes tedious, sometimes a study of racial psychology, and sometimes, despite the writer's best efforts, a more or less inconsequential travel book.

As a student of the Japanese people the writer is persistently friendly without being fulsome and without losing entirely the judicial attitude. He misses no opportunity to point out that much of the feeling against the Japanese is due to mutual lack of comprehension and that there is not sufficient justification for the fact that many Europeans and Americans like the Chinese much better than the Japanese.

The reader cannot but be impressed with the special attention given the "training in moral" or "Seishin Kyoiku" with the religious and semi-religious ceremonies, the visits to national religious shrines and to heroes' tombs, these and frequent lectures. When one considers the hard work, simple fare, bare quarters, and particularly, the exposure lightly clothed to the elements by which the idea is inculcated that simplicity, frugality and ability to withstand hardship are among the principal military virtues, one is quite apt to make mental comparisons with the not infrequent complaint of the warmly dressed, well fed American soldier in France, and particularly of some of his politician friends.

The work of the Japanese Army includes the upbuilding of patriotism in the civil population. Captain Kennedy draws an interesting picture of the visit of a regiment to a country village, and of the friendliness, esteem and hospitality of the villagers.

Captain Kennedy attended the grand maneuvers in 1918, 1919 and 1920. His observations may be summarized as follows. The Japanese soldier has very high morale and wonderful endurance. The cavalry is poor, the infantry excellent, and capable of almost incredible marches. The equipment and tactics are not modern but antedate the World War. Aviation is in a backward state, but improving under the French Aviation Mission. In adopting post-war tactics and equipment, the Japanese are proceeding slowly but their commissions are keeping in touch with the great military nations. It is expected that modernization in all respects will be completed by 1940.

The author gives but a general outline of the Japanese military organization and system of military education. With regard to Japanese fighting qualities, Captain Kennedy believes the discipline of the Army is such as not to justify the belief of many Japanese that, in case of a defeat, the reaction from present Japanese overconfidence may lead to disaster.

While Captain Kennedy's book cannot claim to be a deep study of Japanese military organization, equipment or methods, or of military or racial psychology, it should be an exceptionally useful guide to the "Foreign Language Officer" and is worth-while reading to the American officer for its "close ups" of the military life of a friendly nation.—R. S. A.

Military Intelligence (A New Weapon in War). By Walter C. Sweeney, Lieut. Colonel, U. S. Army. Frederick C. Stokes & Co., New York. 1924. 5½"x 7¾". 259 pp. $2.50.

This is a most valuable work on this subject, and one of the first to be published by an American author. Few men in the United States are more fitted to discuss the subject than the author, as his experience and training has eminently fitted him as an expert.

The World War provided the proof that a struggle between nations had grown out of the narrow limits of decision by arms, and had become a contest in which the whole national strength was engaged on the political, economic and military territories and, last but not least, even in the very soul of the peoples engaged; therefore, the old idea of a purely military intelligence was expanded to include the political, economic and even morale features of intelligence.

This book gives, in perhaps too much detail, the organization and growth of our Military Intelligence, and ably convinces the reader of the value of such a service and its use to our country in war. It shows that Intelligence, like any other new product, must be sold to the consumer, the army as a whole, and in the earlier stages of the war, that was somewhat difficult, but the difficulty lessened as the war progressed, especially purely combat intelligence.

The chapters deal with the Development, the Definition and Organization of Military Intelligence; the problems of Modern War; the Intelligence Service in the World War; the Functions of Personnel; the Collection, Dissemination and Evaluation of Intelligence; Secret Service; Maps and Censorship; and the qualities requisite in an Intelligence Officer.

This book is of general value to all officers of the Army and of special value to the general public, as it is the only authoritative source of information available on this subject.—W. W. H.

The History of Munitions Supply in Canada, 1914-1918. By David Carnegie. Longmans, Green & Co., New York. 1925. 6"x 9". 336 pp. Ill. $6.00.

In 1914 Canada was considered so incapable of supplying powder and shell in quantity that Great Britain requested the Canadian authorities to negotiate with the United States Steel Co. and other manufacturers to obtain ammunition for her. The efforts required by a purely agricultural country to commence the manufacture of materials of war such as ammunition, lumber, airplanes, and ships are related in this book. "The object of this story is to record and preserve accurate and interesting facts of a remarkable achievement by Canadians upon which the statistician may rely and of which the Empire may be justly proud."

Under the leadership and due to the initiative of General Sir Sam Hughes, the Canadian Minister of Militia, a "Shell Committee" was formed which acted as the agent of the British Government in obtaining military supplies in Canada. By the end of the War, this Committee, reorganized into an "Imperial

Munitions Board," "had provided between a quarter and a third of all the shells used by the British Army." In addition, it provided other war materials, expending over $1,500,000,000 in the process. Problems of organization, manufacture, personnel, inspection and transportation had to be met and solved before this record was made possible. The history of the methods adopted in solving these problems and of the results obtained is told in detail in this book.

The author was the Ordnance advisor of the Committee and of the Board. A foreword is contributed by David Lloyd George, the first Minister of Munitions of England.—P. S.

Our Foreign Affairs. By Paul Scott Mowrer. E. P. Dutton & Co., New York. 1924. 5¾"x 8½". 348 pp. $3.50.

Here is another volume in the group of works dealing with our national political affairs that has been reviewed recently in the JOURNAL. This, however, deals primarily with our foreign relations although, in developing this subject, there is necessarily considerable discussion of internal condition and affairs.

The author points out that the international position of the United States has undergone a great change in recent years, that her interests have broadened, that her influence is greater, and that these changes require the careful consideration and determination of her foreign policy and conduct of her foreign affairs. From his preface "My whole aim is, first to set forth our new situation, correcting certain misapprehensions both as to public opinion and as to diplomacy; second, to stimulate interested individuals to think about general aspects of foreign policy for themselves; and, finally, to show them how to go about this thinking, or this study, easily, scientifically. In short, what I have to present is rather a method than a doctrine." This, then, is the substance of the book. It remains merely to say that this substance has been carefully developed. The text brings into focus events from out of the background of our country's history and from them forms clear images of her foreign policies. The reviewer believes that Mr. Mowrer has accomplished his aim; and recommends this book as one with whose contents each officer may well be familiar.—C. D. Y. O.

The Call of The Congo. By Herbert Smith. Powell & White, Cincinnati. 1924. 5"x 7½". 267 pp. Ill. $1.25.

Story by a Christian missionary in Belgian Congo, devoted largely to a study of the natives, their mode of life, customs, traits of character, superstitions. —C. S. H.

Far Harbors Around the World. By Hubbard Hutchinson. G. P. Putnam's Son's, New York. 1924. 6¼"x 9¼". Ill. 324 pp. $3.75.

If any army officer intends to postpone his foreign service tour let him beware of this book, for having read it, he will be eager to start at once.

The author takes you away from the tourists' trodden path and to out-of-the-way and unusual places. With him you climb to the watch towers of the great Wall of China, or gaze at the Southern Cross from a moon-lit deck on tropic seas.

If you wish to take a voyage *de luxe*, having already decided against foreign service, get a copy of this book, an easy chair and be off to the land of your dreams.—L. M. C.

Putnam's Ready Speech Maker. By Edwin Hamlin Carr. G. P. Putnam's Sons, New York. 1922. 5¼"x 7½". 283 pp.

The sub-title of this work aptly sums up its contents—What to Say and How to Say It.

One section of the book is devoted to general suggestions for speakers, covering etiquette for the speaker, procedure on special occasions, methods of training the memory, and the mechanics of speaking.

Another section outlines in detail two methods of home training in the preparation of a speech. Other sections treat of the speaker at his task and provide materials for use in preparing speeches.

This book should be of considerable value not only to those who do not understand the art of preparing and delivering speeches, but to competent and experienced speakers as well.—R. D.

Japan From Within. By J. Ingram Bryan, M. A., M. Litt., Ph. D. Frederick A. Stokes Co., New York. 1924. 5½"x 8½". 288 pp. $4.50.

This book destroys the belief that it is impossible to understand the Oriental, for the author shows how, by intensive study, one may not only understand but also appreciate Japanese institutions and civilization.

From a survey of Japan's relation to the Asian continent we are given a description of her government; an account of her industries and manufacturers together with her commerce, trade and banking; agriculture and forestry are given attention; and the fact is noted that she has not yet solved her labor problem.

The chapters relating to her Army and Navy will be of particular interest to men of the service, while the one on Arts and Crafts can not fail to interest all readers. The last chapter, "The Future of Japan," is a comprehensive survey of Japan's position and a statement of her policy.

This is undoubtedly the most concise and authoritative book to be had on Japan.—L. M. C.

Fortresses are equally useful in offensive and defensive warfare. It is true they will not in themselves arrest an army, but they are an excellent means of retarding, embarrassing, weakening, and annoying a victorious enemy.—*Napoleon.*

THE COAST ARTILLERY JOURNAL

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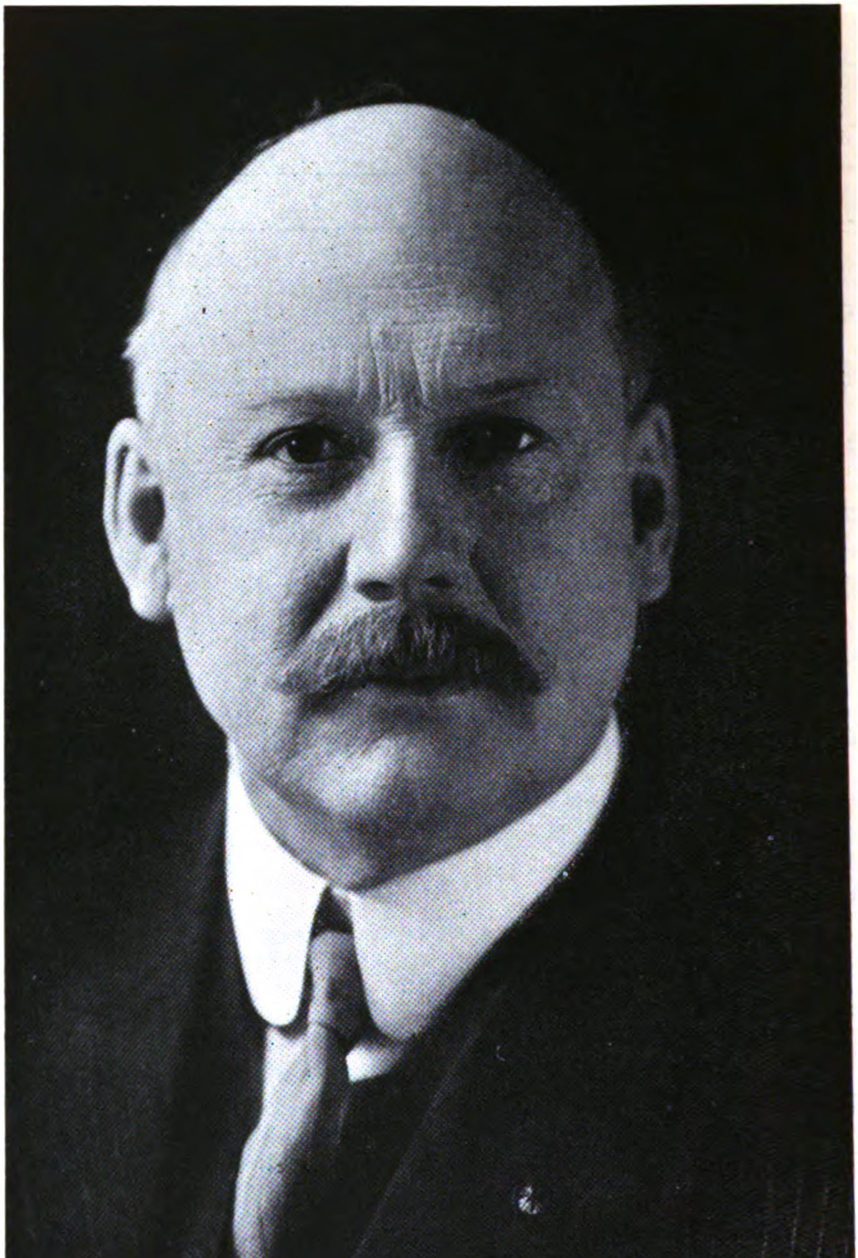

JOHN W. WEEKS

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Command*

By BRIG. GEN. EDWARD L. KING, *U. S. Army*

I AM going to discuss with you this morning what is usually spoken of as "Command." The word *command* is defined, as a verb, in several ways, among which are: to order with authority; to require; to be in authority; to have power or influence. These definitions fit certain conditions but do not fully satisfy the idea of command, as I conceive it, in its broadest sense. The definition carries the thought of authority or power, due in the main to superior rank. Definitions, as such, are often too narrow and restricted, and this is especially true in military definitions. As soon as a definition is formulated, it is subjected to such a barrage of explanations regarding exceptions that one quickly sees that the meaning of many words, as used in the military vocabulary, is governed to a great extent by the context or by the way the word is used. I shall not attempt to lay down a rigid definition of command, but will attempt to create a conception—something flexible, rather than a fixed, rigid rule. I shall attempt to show that a commander should have, besides his power and authority, as per the definition, certain other qualifications which enable him to maintain, by his own ability and personality, that prestige which his military rank confers upon him.

Command has a still further meaning. It carries with it not only personal and other qualities which enable a commander to maintain his prestige, size up the situation and arrive at proper and logical conclusions; but it involves also a knowledge of the workings of the several subdivisions comprising the organization, as well as ability to make the greatest possible use of this organization.

We all admire leaders, but command goes beyond that, and while including leadership as a very necessary part of command, includes also organizational, administrative, and executive capacity.

Many men who are good advisers lack the necessary qualities to reach proper decisions. Others, while making good decisions, forget

*Lecture delivered to the Command and General Staff School, Fort Leavenworth, Kan.

that they have subordinates and try to attend to all the details themselves. Still others conceive, but fail to have necessary details worked out. These are failings which command must avoid.

In our service, in the past, much stress has been laid on general staff work. Some people have been led to believe that the staff was everything and that the commander was a man of straw. This idea was more or less prevalent in some localities during the World War. It is a condition of affairs which should not exist. Still other people say that the staff consists of several types or species of minds, each type being the commander's mind for a particular kind of work. The staff is *not* the commander's mind. If he is a real commander, he has his own mind, but uses his staff as conditions require, all in a certain systematized manner. Any proposition of building up a general staff to serve a straw-man-commander is basically wrong in the American service. It may have its proper place in other services, but not in ours. It should be remembered that general staff officers, as such, have no control or authority over troops and services. Orders which they prepare should be promulgated in the name of the commander and through the channels prescribed by him. The promulgation then assumes that the commander has exercised such supervision as he deems necessary under the circumstances. Unless the commander has previously authorized the use of his name in the promulgation of orders, a staff officer should not assume that power. Naturally circumstances will arise where it is necessary for someone to do something, and in such cases a staff officer, if present, might take the situation in hand, but this should be the exception and not the rule and will be governed by the location of the master mind. The normal procedure should be that the staff officer, knowing the wishes of the higher commander but without specific authority, may and should fully advise the local commander as to what he, the staff officer, believes are the wishes, plans, etc., of the higher commander. But the responsibility and authority rests, and should rest, with the commander on the spot. This does not mean that the general staff officer is or should be a nonenity. Far from it. It is merely a question of the location, duty, responsibility and authority of the several persons, so determined as to secure proper teamwork. The local commander has certain duties, certain responsibilities, certain authority, within his sphere of action. He is placed in his position by the higher command. His responsibility and authority should be equal, co-existent and fixed, and it is not the province or the right of the unauthorized staff officer to assume authority without responsibility. We have all seen staff officers with a modicum of sense—a plethora of gall.

In any time of stress, whether in a large or small force, in an army or a squad, the master mind will come to the front.

Proper command presupposes a condition of affairs wherein the legal commander is the master mind.

We all recognize the great value of staff work. We know it to be indispensable, but it has and must have its specific sphere. Within this sphere, using command in its broad sense, staff work is a part of command.

General staff officers, within their own limits, do and should exercise command functions. A general staff officer should possess the qualities of a commander. He is a part of the command and should make himself a part of the commander. He may, on his own initiative, have to act for the commander, and hence he must possess the same attitude as the commander. In carrying out his duties, the staff officer is and must be bound by the limitations which are properly placed upon his authority.

A commander, in order to use his staff properly, must understand its workings, its powers and limitations, what to expect from the staff and how to use it to the best advantage. This knowledge and its use, with other qualities, constitute command.

Admitting all that may be advanced as to the value and necessity for a staff, the fundamental fact remains and must be recognized that it is the commander, who, making logical use of all available information, makes the necessary decisions. He may seek his information from various sources. He may ask for advice or not. He may consult whom he desires, but in the last analysis he is the deciding authority.

"In war, the leader alone understands the importance of certain things and he may alone of his own will and superior wisdom, conquer and overcome all difficulties."

Having arrived at his decisions, the commander gives to his chief of staff, or to his assembled staff, such directives as are necessary to enable the staff to visualize his ideas and work out the details, each in his own section, all coordinated by the chief of staff. Should the detailed study show that the decision of the commander is not possible of accomplishment, it is then necessary for the commander, with his new knowledge, to make a modified or a new decision.

The decision arrived at should be concise and positive. The directions resulting therefrom must be clear, distinct, authoritative and so worded as to contain no ambiguity nor leave the recipient in doubt as to his particular duties. These instructions should carry with them the feeling that success is unquestioned.

Command is an art. Art makes use of rules but it also transcends all rules. It is governed, however, by principles. Science is knowledge reduced to law and combined in a system. Art relates to something to be done; science to something to be known. Science is the servant of art and is inspired by it.

Command, in a large sense, may be compared to the painting of a picture wherein the commander, at the outset, with only slight or meagre knowledge of events and things, makes a mental sketch, which is his first, perhaps tentative, decision. After receiving the work of his staff, relatively exact information, he is able to complete his picture by a proper use of the staff information. This picture is his final decision. If any colors of his mental picture are faulty, or missing, or not as he had anticipated, his picture will then be faulty or changed, and he must either change his previous conception or secure other colors. As no two artists will produce exactly the same picture though using exactly the same paint, so no two commanders will produce the same results though using the same staff.

Having given a decision, the commander's mind is free to conceive other things and make further decisions as occasions arise. If events so develop that the decision upon which the staff is working has to be changed, the commander must make the necessary changes in his decision, and the staff then must work in accordance with these changes.

A proper coordination by the commander, with cheerful cooperation of the staff is essential in a command. Authority, organization, decision, and supervision constitute command. Supervision and direction by the commander does not interfere with the subordinates' initiative if they are properly used. Their proper handling is command. At certain times, precise control or direction of the initiative of subordinates is necessary. This is particularly true when the subordinates are but little known to the commander or before full indoctrination. Precise control in the early steps of an operation may also be necessary in order that the proper and intended direction and impulses may be assured. The handling of this precise control involves the Art of Command.

It is an axiom that orders should not be projected too far into the future. But no limit should be placed on the foresightedness of a commander. It has been said that of the three things the enemy may do, he will usually choose the fourth. It is, therefore, necessary for the commander to be prepared for all conceivable contingencies. The staff must be cognizant and appreciative of all conditions in order that their work may be based on solid foundations, not on the shifting sands of ignorance or self-deceit.

With a staff well trained in the technique of the various sections, loyal to the chief and to the cause, possessed of proper teamwork, there can be no objection to considering the future. It must be done. There will be no loss of morale due to change of plans (provided it is not vacillation) on the part of the commander, and when the fourth of the three contingencies arises, the commander and his staff—the command—will face the new situation with a fixed determination to meet the new crisis with extra vigor.

It is not intended to imply that the commander has been waiting for the enemy to act. We all know that—to paraphase—"He who waits is lost." While one may temporarily adopt a waiting attitude—to win, to annihilate, one must move. What is here meant is the various reactions by the enemy that may result from our own action.

In this—the new directive to counter the reaction of the enemy, the line of action to be taken—the *decision*—must be made by the commander. On his "say so" to go right or left, forward or back, attack, hold, or retreat, all must depend; and upon his decision as a foundation, all the work of the various sections of the staff must be based. It may not be the best, but it is bound to be better than a scattering of everything under innumerable decisions.

A football team composed of individuals of medium ability, indoctrinated in teamwork and led by a real leader, will beat a team of hastily assembled stars, all wanting to carry the ball individually and in eleven different directions. What is desired in command is this same team of stars, individually well trained, thoroughly indoctrinated in teamwork and led by a field captain whose signals (decisions) normally will be the best; but whether or not considered by all as the very best under the circumstances, the play signalled must be pushed to the limit by all until the ball is down.

Having given the directive, the commander then has his mind clear to meet the next situation which may develop. If events so happen that a change in plans must be made, to take advantage of fleeting opportunities or to meet unforeseen reactions of the enemy, the commander's mind is the master mind to determine the line of action, to render the decisions which will govern the new movements of his command.

In the directive—the memorandum which he gives his chief of staff—the commander, assuming a competent staff, should be careful not to go so much into detail as to do the work of his staff. This staff is presumed to know how to work out these details and the members of the staff are entitled to and should be allowed the same initiative

within their several spheres as the commander expects that his superiors will permit to him.

To use again the analogy of the football team, the commander is the one who gives the signal. The signal in itself tells each member of the team (the staff) what he is to do. No time is taken to tell each lineman of a team how he is to handle his man for the play called for, nor is each interferer told how to take out his man. Each player is presumed to be competent, else he would not be on the team. It should be the same with the staff.

Again, every one on a football team should at all times keep the field captain informed as to whether his opponent is hard to handle, so that plays may be intelligently selected. In the same way, staff officers should keep their chief constantly informed as to the possibilities, favorable or unfavorable, of their several sections in order that the commander may intelligently estimate the situation and arrive at reasonable, workable, sound decisions.

This is team work in its highest form. It is command.

Teamwork means making a workable machine out of different parts. As the members of the team vary, so must the particular methods for making the team vary; but the general principles apply in each case. The organization and proper functioning of a team involves the understanding of the Art of Command.

Personal qualifications of a commander are important and manifold. He must, first of all, have character. With this character must go many other qualities. Among these may be mentioned knowledge of his profession, with a proper amount of intelligence to enable him to utilize this knowledge. All of us have seen men who were educated beyond their intelligence, sometimes known as "bright damn fools." These are not commanders.

One of the best known sayings of the late Colonel Henderson is that "The Art of Command, whether the force be large or small, is the art of dealing with human nature." In his book *The Science of War*, Colonel Henderson reminds us that we have to deal in war not so much with numbers and arms and maneuvers, as with human nature.

Napoleon said that he found in the study of the great campaigns not merely a record of marches and maneuvers, and the use of intrenchments, but a complete study of human nature under the conditions that exist in war; human nature affected by discipline, by fear, by need of food, by the weight of responsibility and by patriotism.

Commanders whose daily work it is to govern men, must realize and be guided by this axiom: soldiers, when organized in companies

and battalions, think and act differently than they think and act as isolated individuals. For the essential distinction between a body of soldiers and a crowd of men is that the former are trained together to act under one leader, so that the group—it may be a platoon, it may be a battalion—develops a vitality of its own and has mind and spirit separate and different from those of its members. The psychology of the platoon or battalion must no more be neglected than the psychology of the individual soldier.

"Who knows the art of impressing the imagination," said Napoleon, "knows the art of ruling." A wise commander has more power over his command as a whole than he has over the individuals composing it. For the mind of the commander acts directly on the spirit of the group, whose members are animated by a common purpose, whose collective action the commander guides towards a single end.

The collective spirit of a group is not merely the sum or resultant, of the minds of the men composing it. Its life is far longer, its memory more retentive, its imagination more vivid. Consequently, it is more responsive to the appeals of tradition and of history, and more responsive to the guidance of its leaders. Therefore, those who would study the Art of Command must also bear in mind this second axiom, "The collective life of a group attains a far higher level, intellectually and morally, than the average of its members."

Those who pay no heed to these two axioms limit their power of command in two ways: they make no appeal to that which is most responsive in the mind of their command, and they exercise no influence over what is best and highest in the spirit of their men.

No one can dispute the importance of the Art of Command, but by inaction we imply that it is not only a subject which we cannot teach, but also that it is a subject which cannot be taught—and so, to comfort ourselves, we say that a man is either a born leader or a born fool, and that is the end of it. But that is not the whole truth. There are some men, it is true, who are born supremely gifted in this way, but many of us can only learn by our own efforts and through the experience of others, the principles of this, as of any other art.

It is said that all men, and indeed all animals, may be divided into two classes—those who instinctively seek to lead and those who by nature are content to be led. It is obvious that either by nature or by training, all officers, to be effective commanders, must belong to the former class.

Of the qualities which fit for command, none is more essential to inspire confidence than strength and vigor, and a commander, whether he leads a pack of dogs or a company of men, must not only possess vigor, but he must also show that he possesses it. A commander whose orders, once given, are not invariably obeyed is soon despised by his command, because the command, like a pack of wild dogs, instinctively demands those qualities in their leader, which are needed for the safety of the pack, or, for the well-being of the command. He may consult freely and often with his subordinates, but a decision once given there must be no further discussion. An army is happy under a strong commander, but not under a soviet committee.

If a commander has no faith in himself, he may feel perfectly sure that his doubts will be universally shared by all under him. Knowledge breeds self-confidence. If his mind is filled with doubts and hesitations, it is best for him to hide them from himself if possible, but most certainly from his men.

A loyal commander can count on loyalty in others. Although it is a fact not always remembered, a *commander* who is disloyal can count most surely on being the direct cause of disloyalty in others. A *disloyal commander* will infect his whole command with the same fatal spirit, for it is indeed the spirit of ruin and disaster. "When the salt has lost its savor wherewith shall it be salted?"

A sense of justice is perhaps a quality equally as important as vigor in a commander. If it be not universally felt that a spirit of justice animates all commanders, then discipline, good spirit, and real cohesion vanish. We all make mistakes at times. Soldiers forgive and excuse many mistakes in their officers. But if a command, rightly or wrongly, convicts its commander of injustice, then God help that commander in peace and in war, for most certainly his men will pardon him nothing.

A commander must be direct and simple or his men will not understand what he is driving at. *Individually*, we may tolerate and laugh at a humbug, but we do not do so *collectively*. Humbug in a leader is too great a danger to an army for the army to put up with sham. Whatever a commander says or does, let him say or do it in all sincerity. A man who has no faith in his own actions, no belief in what he preaches, may deceive some indivduals, but never the collective mind of his command.

The commander must have a great supply of common sense. As I have stated previously, I was once impressed by a statement that the successful commander was a man who "had seven parts common sense and one part *dope*." The best the educational system of the Army can do for a man is to give him the *dope* with the opportunity

to practice utilizing it with common sense. Only the Lord himself can supply the common sense.

There is an adage, "You can't put temper in an axe by filing the edge." We may say that the proper kind of a commander is the axe with proper temper; that is, character. Having this sort of an axe, its value may be much increased by the proper use of a file—education. Carrying the analogy still further; that use of education which produces dogmatism, bigotry, pedantry, may be compared to that use of a file which takes the edge off the best tempered axe.

General Sherman has indicated that a successful commander must be a man of action and certainly his record carries out this idea. He says, "Of course knowledge is power, we all know that; but mere knowledge is not power, it is simply possibility. Action is power and its highest manifestation is action with knowledge. 'Tis not the man who *knows* most, but the one who *does best*, that wins. Grant, and Meade, and Sheridan at the close of the war could have been taught many lessons by our learned professors, but none of these could have guided the forces to victory as did Grant at Chattanooga, defended his position as Meade did at Gettysburg, or hurled his masses as Sheridan did at Winchester. Action guided by knowledge is what is demanded of the modern general. He must know as much of the school of the soldier as any man in the ranks; he must know what men can do, and what they cannot do; he must foresee and forereach to provide in advance the food, clothing, ammunition, and supplies of every nature and kind necessary for the maintenance of the command; and moreover, he must gain the confidence and affection of the men committed to his care."

Command carries with it the idea of personal direction. For instance, a captain commands a company; Napoleon commanded his armies. In both cases the commander was able, due to the size and position of the forces, to exercise direct and personal influence. With the larger armies and the more extended formations of the present, personal contact is not so close, nor the effects so direct. This *must* be and *can* be overcome by correct indoctrination of all ranks. The feeling of moral cohesion is more than ever needed. This feeling of solidarity can only exist on the widely extended front of a modern battlefield when men have been trained to rely on the support of their comrades and of their commanders; when they know, that to be out of sight is *not* to be out of mind.

"Close order," said General Maud'huy, "is the guarantee given by discipline in the presence of danger. The sense of moral solidarity must, in these days, take the place of close physical contact." This sense of solidarity can only be inspired by a commander who

is in perfect sympathy with the men of his command—whose men are moved by the same emotions and impulses as himself. The commander, although he is the directing brain, is not *separate from,* but the most vital *part* of his own command.

Study the capacities, character, and mind of the individual; pay every heed to the private rights of the private soldier, but remember that a commander's duty is to his command as a whole. He is a useless commander who has a kind heart and no high sense of duty. Even though individuals may suffer, a commander must never hesitate to make whatever demands are needed for the collective good of his command. Soft-hearted commanders are responsible for more crime in an army and more casualties in war than are hard-hearted men.

A commander must have prestige. An officer gains prestige—or is it only the reflection of the real article?—from his rank, from his uniform, and from the power and the authority which are given him by the Regulations. But true prestige is not acquired by passing an examination or by receiving a commission. When Napoleon said he hated unlucky commanders, he expressed the feelings of all who serve under them. But continuous success is not necessary to acquire prestige. No commanders were ever more trusted by their armies than were Stonewall Jackson and Lee. A commander who demands much of his men must ggive much; he can only inspire confidence when he shows knowledge, respect when he proves himself just, good order when he shows himself resolute.

That commander is most skilled in the art of command who has so trained his men that in the hours of stress and crisis they continue obedient to the impulse which bids them, regardless of themselves, do their duty by their regiment, fight for the flag, and, if need be, die for their country.

The good is the enemy of the best. Look after the morals of the company and the scamps will need to look after themselves. Create a strong collective spirit and even the most unruly men must need conform to its will.

It is instructive to consider how closely the qualities of armies correspond with the qualities of their commanders. Dash, or élan vital, is the first quality, most of us would say, that marks the French Army; and the kindred qualities of energy and imagination are what have chiefly distinguished, and still distingush, its commanders—Napoleon and many of his marshals, Foch and some of his principal generals.

Marshal Foch, in speaking at the War College, said it was hard to get orders executed. Training in a "common language"—indoctri-

nation which leads to teamwork, will be a long step in the proper direction.

Besides command as exemplified in the person of the commander, and command as related to the commander and his staff with the commander as the head, the relation of commander to his subordinate tactical commanders is important. When actions are contemplated or orders are received to carry out any designated operation, it is conceivable that the commander would discuss the affair with his chief of staff and give the latter, as the head of the staff, such directions as may be pertinent. Either before or after receiving from his staff any desired detailed information, the commander may well gather his immediate subordinate tactical commanders and also, and better still, those tactical commanders next to the immediate subordinates, and go over matters with them. No council of war is here intended, but a conference wherein the commander elaborates on formal orders, clears away fogs and otherwise assures perfect understanding and teamwork. In this way command in its usually accepted meaning may be exercised.

Naval history furnishes one of the best illustrations of this sort of action. While Lord Nelson was *en route* to the scene of the Battle of the Nile, it was his custom to assemble his captains on his flagship almost daily and with them go over the possibilities of the future, explain his ideas in principle and detail and otherwise impress his personality upon his subordinates. He thus indoctrinated his captains, and in the best possible manner, exercised command. As a result, the Battle of the Nile was fought to a successful issue *contrary* to the *specific plan* but in *strict accordance* with *Nelson principles.* Nelson was a *commander* and exercised command in its highest degree.

This sort of command may be further increased by frequent visits on the part of the commander to the units of his command. Instructions in the American Expeditionary Force that division commanders must know the location of battalion command posts is indicative of the ideas of the American High Command upon this subject. In this and in other ways the commander will be able to impress his personality upon the members of his command.

Free intercourse between the commander and his next tactical subordinates should be a governing principle, carrying with it, of course, such teamwork on the part of the commander as will result in keeping his staff informed as to all developments. Details as to methods will vary with men and conditions, but the net result will be the elimination of what we may call staff interference and staff control and the aggrandizement of command in its true sense.

In an American force, it is especially true that this feature of command must be emphasized. The psychology of the American soldier—the type of person, both commissioned and enlisted personnel, of which our armies will be composed—requires this sort of command to insure the best results.

The commander must have an understanding of men, both as individuals and as a crowd, with the administrative ability to utilize this appreciaton of the human elements; and to these may be added the physique necessary to maintain himself at his maximum mental limit, and such personal qualities as will enable him to maintain, on personal contact, that prestige which his position warrants him in expecting.

It may be said, and very properly, that the commander as here pictured is impossible of attainment by any one person—that a superman is shown. Indeed, Napoleon says in one of his maxims, "It is rare, and difficult, to possess, at one time, all the qualities of a great general. What is desirable is to maintain an equilibrium between his mind and abilities, and his will and courage. If courage prevails more in his composition, the general will undertake designs, the whole possibility of the attainment of which he has not thought out; on the other hand he will not dare to carry his ideas into execution, if his will or courage is inferior to his abilities." It is highly probable that a few men have possessed all of the necessary qualities in a superlative degree. But this is the sort of man that is desirable as a commander. Our efforts, therefore, should be to arrive as near this goal as is possible.

Many great commanders have had with them a man who possessed the qualities that they themselves probably lacked in some degree. Napoleon and Berthier, Blucher and Gneisenau, Grant and Rawlins, Foch and Weygand, Hindenburg and Ludendorff, are a few examples.

It may be well for all of us to take careful inventory of our own qualifications and when placed in a position of command, seek for a man who possesses in a high degree the qualities we know ourselves to lack. At the headquarters of a high command, it is highly probable that there will be found men who possess one or more of such qualities as the commander may lack, and if he is frank with himself, he will search for these men and make use of them to supply the deficiencies his study of himself has shown to be lacking.

An honest evaluation of one's own qualities with proper appreciation and use of the qualities of others make for proper command.

Preparations for the Second Battle of the Marne

By Colonel Conrad H. Lanza, *Field Artillery*

Editor's Note: *With the collapse of Russia in the winter of 1917-18, Germany began the transfer of troops to the western front in preparation for a decisive campaign against the Allies. Attacking on March 21 on a fifty-mile front between Croisilles and the Oise, the Germans advanced some thirty miles in the center and made a tremendous salient in the St. Quentin area. Brought to a standstill on April 16, Ludendorff turned to the north and attacked on April 9, on a twelve-mile front from La Basse to the Lys, with a view to breaking through to Bethune and on to Hazebrouck. This attack created another, but smaller, salient in the area about Armentieres, but it was finally brought to a stop on April 29. Finding the effort to reach Hazebrouck too costly, Ludendorff again shifted the scene of battle, attacking on May 27 on the line southeast of Laon to secure the line of the Vesle river and the railroad from Soissons to Rheims, involving an advance of from five to ten miles. The initial results so exceeded anticipations that Ludendorff changed his plans and continued his drive on this front. By May 30 he had reached the Marne from a point three miles east of Dormans to a point four miles east of Chateau-Thierry, creating a salient thirty miles deep and thirty-five miles wide at its base. In the succeeding days he attempted to widen the salient, but met with no considerable success. Finally, on June 9, the Germans began an advance on the line from Montdidier to Noyon, where, in two days fighting, they gained some six miles on a narrow front. This advance was stopped in the fighting preceding June 15, leaving the Germans in possession of a line from the vicinity of Rheims through St. Agnan and Vaux to Ambleny, west of Soissons. This marked the turning point of the war, and in the following interesting article the author discusses the preparations made on both sides for continuing the campaign.*

On June 15, 1918, after the German advance which had started on May 27 had stopped, the Allied armies in the sector involved in the German attack, which included the line along the Marne, were as follows:[1]

Reserve Group of Armies (French), General Fayolle:

First French Army, from the Somme to Montdidier;

Third French Army, from Montididier to the high ground between the Oise and the Aisne;

Tenth French Army, from the right of the Third Army to the Ourcq, General Maistne (later General Mangin).

Center Group of Armies (French):

Sixth French Army, from the Ourcq to Dormans on the Marne, General DeGoutte;

Fifth French Army, from Dormans to the Vesle, General Barthelot;

Fourth French Army, from the Vesle to the Argonne, General Gouraud.

Opposite these forces, covering the Marne salient, was the German Group of Armies, under the Crown Prince, including:[2]

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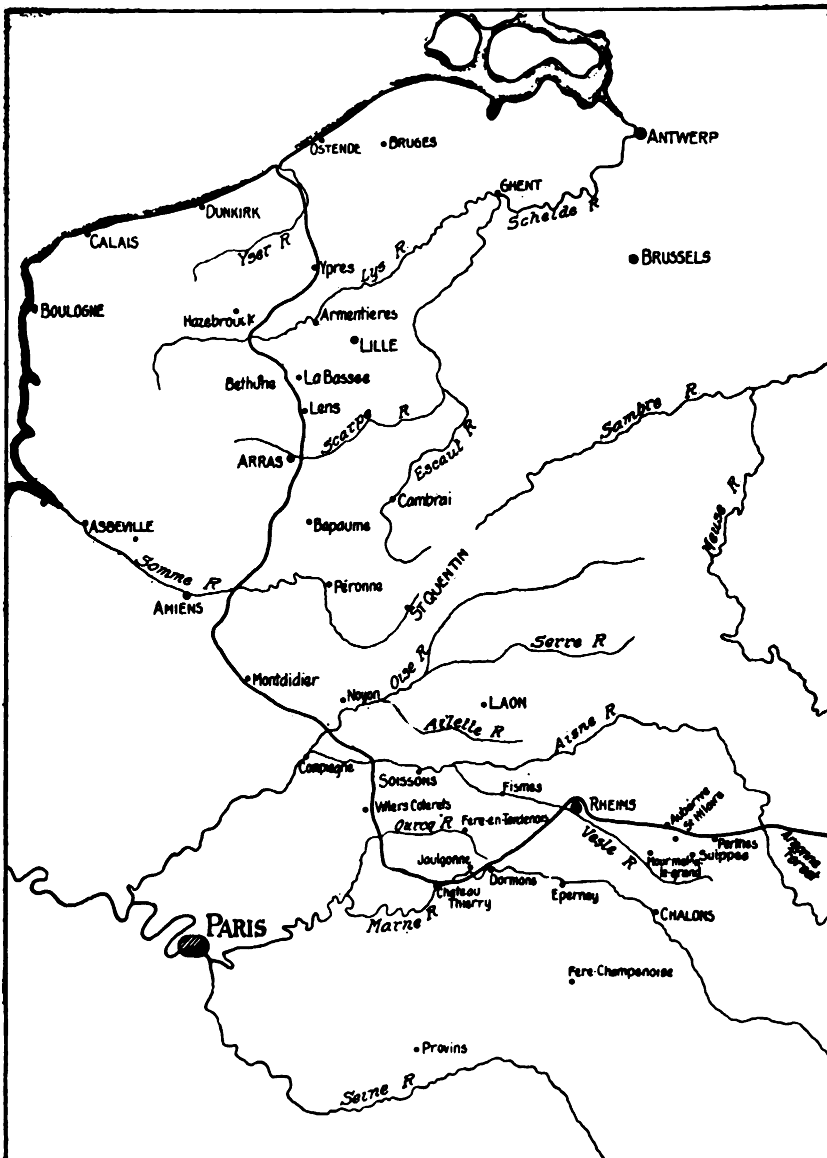
[1] *Guerre de 1914-1918, Ecole Superieure de Guerre, 1919-1920*, p. 43. French Order of Battle, June, 1918.

[2] War Diary, Army Group, German Crown Prince.
War Diaries, Seventh and First German Armies.
General von Zwehl, *The Battles of the Summer of 1918 on the Western Front*, (Berlin, 1921).



THE SECOND BATTLE OF THE MARNE
SHOWING BATTLE LINE OF JULY 14, 1918.

ENGLISH MILES
0 5 10 20 30 40
0 5 10 20 30 40
KILOMETERS

Seventh German Army, from north of the Oise and the line Fismes-Gueux (just west of Rheims), General von Boehn;
First German Army, east of the line Fismes-Gueux to St. Hilaire, General von Mudra;
Third German Army, east of the First Army to the Argonne, General von Einem.

The Seventh Army, which held most of the Marne salient, contained eight corps. Including divisions in reserve, there were about forty dvisions within the Marne salient.[3] To supply these divisions there was only one standard-gauge railroad, leading through the vicinity of Soissons (twenty kilometers from the front) to Fere-en-Tardenois (twenty-five kilometers from the front). Roads supplemented the railroad, but the railroad was probably the main dependence for supplies. Of the roads, one excellent highway, extending south from Soissons, was very close to the front; and another extending south from Fismes was as close to the front as the railroad, while the railhead at Fere-en-Tardenois was nearly at the center of the salient.[4] This salient was so narrow that any advance from the flanks toward Fismes would threaten the existence of the German forces along the Marne. The precariousness of German communications was pointed out in a bulletin issued by the Tenth French Army on June 5.[5]

On June 7, Marshal Foch directed General Petain, commanding the French forces in France, to prepare for an attack to be made against the east flank of the salient by the Fifth French Army, and on June 14 and 16 this order was supplemented by additional ones directing that the Tenth French Army prepare to make the main attack on the west side of the salient.[6]

To carry out these instructions, General Petain issued orders to the Fifth Army on June 8 and to the Tenth Army on June 16. Additional orders were issued on June 20.[7] These orders required thorough concealment of preparations and bringing up infantry during the night preceding the commencement of the attack, which was to be preceded by a short, violent artillery preparation. The infantry attack was to start at daybreak.

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[3] *Op. cit.*
Guerre de 1914-1918, p. 44.
Operation Orders, Seventh Army.
[4] Current maps.
[5] See extract copy (translated) in Summary of Information, GHQ, A. E. F., No. 71, June 10, 1918.
[6] *Guerre de 1914-1918*, p. 44.
Letter to French C-in-C, No. 1,454, June 16, 1918.
[7] Letter to Fifth Army, No. 8,861, June 8, 1918.
Letter to Tenth Army, No. 18,982, June 16, 1918.
Letter to Fifth Army, No. 24,540, June 20, 1918.

The Tenth Army completed its plan for the attack on June 26, within four days. As its attack was to be the principal one, it was to receive the greater assistance. The Tenth Army plan provided for:

Preliminary Operations — Attacks, with limited objectives, to obtain a good line of departure for the main attack.

Main Operation—Attack with entire army, toward the Soissons-Chateau-Thierry road, to seize the high ground between the Aisne and the Ourcq.

This plan was approved June 27, and the preliminary operations were carried out, as planned, on June 28 and on July 8, 12, and 13, resulting in securing the desired line of departure east of the Conevres ravine and in the edge of the Villers-Cotterets forest.[8]

In the meantime the Germans themselves from early June planned to resume the offensive. Hindenburg states that he felt the semi-circle composing the Marne salient to be an insecure position, and that he realized the poor line of communication on which the salient depended and the danger to which the Germans were exposed by remaining quietly in the sector until the enemy attacked. The situation could be improved only by the capture of Rheims, orders for which operation were issued June 19.[9]

The Germans seem to have believed that the mass of allied reserves were in the vicinity of Compiegne and Villers-Cotterets, that there were no large bodies of troops south of the Marne. Strong forces, French, English and Italian, were identified about Rheims. East of Rheims the situation seemed to be the same as had existed for a long time. There was little information as to American troops, but it was believed these would soon be available in large and increasing numbers, so that an early offensive by the Germans was desirable.[10]

No direct attack on Rheims was intended. Instead, the high ground between Rheims and Epernay was to be seized by a surprise attack about July 20, and, the better to enable this to be done, a part of the Seventh and First Armies were to cross the Marne on both sides of Dormans, and then attack toward Epernay.[11] To protect

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[8] Official Communique.
Intelligence Reports, Seventh German Army, June 28, July 12, July 13.
Intelligence Reports, Ninth German Army, July 8, 9, and 12.

[9] Von Hindenburg, *Out of My Life*, p. 370.
Intelligence Reports, Army Group, German Crown Prince, June 13, *et seq.*
Letter, German GHQ, *Ia* 2608, June 19, 1918, to Seventh Army, states in part: "Herewith plans of the attack of the Seventh Army. The mission of the attack is to cause the fall of the hostile positions on the Rheims plateau by taking the crossings at Epernay."

[10] Intelligence Reports, German GHQ for Western Front, June, 1918.
Out of My Life, pp. 371-2.

[11] *Ibid.*, p. 313.
Ludendorff's *Own Story*, II, 305.
Battles of 1918, von Zwehl, *cit.*
Orders *Ia* 8685, German GHQ, June 14, 1918.
Orders *Ia* 2610, First German Army, June 15, 1918.
Orders *Ia* 844, Seventh German Army, June 25, 1918.

this attack on the west side of the Marne salient, the Seventh Army was relieved from watching the greater part of this side by the Ninth Army, under General von Eben, brought from Rumania, and which took over the three Army Corps of the Seventh Army between the Oise and the Ourcq.[12]

This change was completed by July 5.[13] Ludendorff states in his memoirs that an allied offensive toward Soissons was expected and prepared for,[14] and this is confirmed by the German Intelligence Reports, particularly those from the Ninth German Army.[15]

After making preparations for the capture of Rheims, the German plan was later extended, as the result of various conferences, by extending the attack eastwards to the Argonne with a view to cutting off Rheims from the southeast and possibly reaching Chalons-sur-Marne.[16] This extension of the attack was desirable from a strategical standpoint, but was justified only so far as the number of men and guns available were sufficient to afford a reasonable chance of success. Later events showed that the German attacking forces on the Marne alone were too weak, weaker than the forces being attacked, and this weakness was one of the prime causes of failure.[17] The extension of the attack east of Rheims was not, in fact, justified.

For the proposed attack, the German Seventh Army, under General von Boehm, had available:[18]

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[12]Ludendorff's *Own Story*, II, 307.
War Diary, Ninth Army.
War Diary, Seventh Army.
War Diary, Army Group, German Crown Prince.
Orders, First Army, Ia 2740, June 28, 1918.
Orders, Army Group, German Crown Prince, Ia 2622, June 21, 1918, and Ia 844, June 25, 1918.

[13]War Diary, Ninth German Army.
Orders Ia 6023, Army Group, German Crown Prince, July 3, 1918.

[14]Ludendorff's *Own Story*, II, 307.

[15]Urgent telephone message, Army Group, German Crown Prince, 12:36 p. m., July 11, 1918, to the Seventh and Ninth Armies stated: "Deserters taken by Ninth and Seventh Armies speak of strong concentrations of troops in the woods of Villers-Cotterets and of an impending attack on a large scale. * * * Reconnaissance service should be increased to the utmost, and arrangements must be made to have, at the beginning of the hostile attack, sufficient security detachments with the artillery, in readiness, in positions in rear. * * * "

On the same date, another telephone message was made by this Army Group to German GHQ (No. Ia 6079), in part: "According to the statements of deserters, a hostile attack is imminent against Corps Watter and the two Corps sectors adjoining. It may be expected that the attack will be made not later than July 15, if not made before then."

On the same date, par. 1 of Ninth Army orders (Ia 287, op) reads: "According to statements of prisoners and deserters at least one fresh French division has been inserted in line opposite the left of Corps Staabs and the center of Corps Watter. Strong reserves are in the woods in rear of the hostile front, among them British, American and black troops. The hostile artillery has been materially reinforced, and portions of it are far in front. Tanks and cavalry are being held in readiness. We must reckon on an imminent hostile attack on a large scale."

The Seventh German Army orders of July 11 (Ia 187) also states: " * * * the situation on the front Nouvron-Troesnes is acute, and we must reckon on hostile attack intentions * * * ."

In a letter to German GHQ, No. Ia-II 9038, July 1, 1918, Ludendorff called the attention of the Crown Prince that numerous tank squadrons must be reckoned with in case of large scale attacks.
Orders Ia 8720, German GHQ, June 17, 1918.

[16]Hindenburg, *Out of My Life*, p. 378.

[17]To be discussed later.

[18]Instructions, Seventh German Army, Ia 797, June 19, 1918, *et seq.*

XXIII Reserve Corps, opposite Mezy, General Kathen;
VIII Reserve Corps, east to Dormans, General Wichura;
IV Reserve Corps, north to Athenay, General Conta;
55th General Command, north to Chambrecy, General Schmettow.

The number of divisions appears to have been thirty for the entire army.[19]

For the same offensive, the First and Third German Armies seem to have had about fourteen and ten divisions respectively, or a total of twenty-four east of Rheims[20] for the attack in Champagne.

These figures seem to indicate the relative importance placed by the Germans on the two attacks. The east attack, while desirable, was not essential to the assigned mission of capturing Rheims in order to safeguard the Marne salient. But extending their efforts too far, the German resources were unable successfully to undertake either offensive, and both failed.

The Seventh German Army had a difficult task. It had a river crossing in the right sector of its attack and the extensive forests of Enghien and Vassy in the left Sector. These two forests contained numerous lakes and swamps, and the country around them was hilly. They constituted a formidable obstacle.[21]

East of Rheims the terrain did not offer special difficulties, but the opposing lines had held the same positions so long that they were strongly fortified. The XV Corps, of the First German Army, encircled Rheims and was to support the attack with fire, while the three adjoining corps to the east,—the VII Reserve, the XIV, and the XXIV Reserve, were to penetrate the hostile positions between Prunay and Auberive, inclusive, and to push forward—with proper security against Rheims and the wooded hills there—with strong forces on both banks of the Marne against Epernay, and force a junction with the Seventh Army. Three Corps, the XII, I Bavarian, and XVI, of the Third German Army, occupied the front from Mourmelon-le-Grand eastward, and were to seize the line hills east of St. Etienne—Somme Suippes—hills southeast of Perthes. A fur-

[19]German strength reports, July 13, 1918, (for detailed list see page 14). The identifications published in Summaries of Information, GHQ, AEF, do not agree exactly with the German reports. The identifications were: 1st Guard, 2d Guard, 4th Guard, 5th Guard, 1st, 22d, 23d, 26th, 33d, 36th, 37th, 40th, 50th, 87th, 103d, 113th, 123d, 195th, 200th, 201st, 10th Bavarian, 12th Bavarian, 10th Reserve, 24th Reserve, 28th Reserve, 78th Reserve, 6th Bavarian Reserve, 10th Landwehr, 4th Ersatz, Bavarian Ersatz—30 divisions in all.

[20]Summary of Information, GHQ, A. E. F., reported identifications as follows: *First Army:* 3d Guard, 1st, 26th, 86th, 203d, 238th, 239t h, 242d, 15th Bavarian, 19th Reserve, 80th Reserve, Guard Ersatz.

Third Army: 7th, 80th, 88th, 228th, 1st Bavarian, 2d Bavarian, 7th Reserve, 33d Reserve, Guard Cavalry.

Note that the 1st Division was also reported with the Seventh Army, and that the list does not entirely agree with the German strength report, given later.

[21]See Map.

ther extension toward the east was contemplated should the attack turn out favorably.[22]

During the period of German preparation, Marshal Foch, while preparing for an offensive by the allies, undertook also to oppose further German attacks. In letters sent June 2, during the Aisne battle, and June 17, after the battle, to American GHQ, he asked that five American divisions then with the British army be placed at the disposal of the French C-in-C (General Petain) to relieve French divisions in quiet sectors in east France. On June 19, Marshal Foch directed the British C-in-C to release six French divisions with considerable French Artillery, then with the British Army in Flanders. The French divisions thus obtained formed the allied strategic reserve.[23]

On the 27th, the G-2 section of General Petain's staff submitted a memorandum on the subject of a German offensive, which summed up the situation as follows:[24]

a. In view of the condition of German resources in men, only large operations, promising great results, will be undertaken.

b. It will require at least until July 15 to prepare such an offensive.

Notwithstanding early ideas as to an offensive, defensive measures were still provided for. The Tenth French Army, as previously noted, did not conclude its preliminary operations for an offensive until July 13. On July 1, Marshal Foch issued Orders No. 4, which, in part, stated:

> * * * the enemy has been stopped 30 kilometers from Dunkirk, 60 from Abbeville, 60 from Paris, 25 from Chalons.
>
> An advance of 40 kilometers toward Abbeville will cut the communications with the north part of France, and will separate the French and the British Armies.
>
> An advance toward Paris, even if not so great, without influencing operations decisively, would seriously affect the political action * * *.
>
> Paris and Abbeville are then the places that must above all be covered.

The order then prescribed that, on the sector Chateau-Thierry to Lens, steps be taken to defend every foot of ground, and that, in addition to local reserves in Flanders and Champagne, the main re-

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[22]Orders *la* 2605, First Army, June 21. 1918.
Orders *la* 2622, Army Group, German Crown Prince, June 21.
Orders *la* 844, Army Group, German Crown Prince, June 25.
Orders *la* 2740, First Army, June 28.

[23]*Guerre de 1914-1918*, p. 47.
Order 1584, Allied GHQ, June 19, 1918.

[24]*2eme Bureau, Etat Major Francais, etude No. 8122/XXII.*

serves be placed so as to be able most quickly to come into line near Paris or Abbeville. The order ends with the statement:

> The allied reserves will enter the battle wherever it takes place. To assist their suitable and coordinated intervention, these reserves should, if possible, be organized into corps or armies.

There are several points worthy of attention in this order. Whereas strenuous resistance was ordered to be made on the line north from Chateau-Thierry, there was no such requirement as to the front east from Chateau-Thierry. In part this was probably due to the G-2 memorandum of June 27 which, from a purely hypothetical study, considered that the next German offensive would be neither toward Abbeville nor toward Paris, the two points which, if reached or approached, seemed to offer the greatest advantages to the Germans as being the most dangerous to the allies. An attack east of Chateau-Thierry was not considered as particularly advantageous to the Germans or dangerous to the allies. It was therefore thought rather improbable, and not specially important if it did occur.

In fact, the Germans thought, on their part, that a decisive battle which would probably result in bringing the war to a close in their favor ought to be made suddenly about the end of July and be directed toward Paris, and they issued preliminary orders for this on June 22. On July 4, General Ludendorff ordered that preparations be made to extend this attack to include Amiens.[25] But they also felt, as already discussed, that the Marne salient was in such a dangerous condition that the situation there would have to be improved before they would be justified in concentrating their reserves in Flanders. While the Rheims operation was a special one with a limited objective, it was hoped that the attack on Rheims would draw the allied reserves away from Flanders, thus facilitating a later decisive attack toward Abbeville.[26] The observed allied preparations for an attack toward Soissons were not seriously considered as dangerous in view of the presence of the Ninth Army.[27]

The French memorandum of June 27 and the order of July 16 were incorrect in assuming that the Germans would not undertake operations with limited objectives but would confine themselves to major operations with unlimited objectives toward either Abbeville or Paris. The German expectation that the allied reserves would be

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[25]Letter Ia 8895, German GHQ, June 22, 1918.
Letter Ia 2829, Army Group, German Crown Prince, June 26, 1918.
Ludendorff's *Own Story*, II, 311, states that this attack was to be made north of the Lys, but this is not borne out by the German orders examined—message, German GHQ, 9:45 a. m., July 4, 1918, No. Ia 8994.

[26]Hindenburg, *Out of My Life*, p. 371.

[27]See Footnote 15.

sent to Rheims when that city was seriously threatened was also incorrect. These reserves were stationed where transportation lines were such that they could be quickly concentrated near Paris or Abbeville.[28]

The French order of July 1, as a result of not prescribing a strenuous defense east of Chateau-Thierry, led naturally to the adoption of an elastic defense along the Marne and in Champagne to conserve losses, a serious matter in comparison with the relative unimportance of German gains in terrain in these localities.[29]

The order of July 1 foresaw the employment of the reserves in large masses, requiring them to be organized into corps for this purpose, and presumably, if their number could be made sufficiently large, into one or more armies. This method of employing reserves differs radically from the common one of reinforcing organizations already in line. It requires that the organizations in line be given a *defensive* mission, while the *offensive* is to be undertaken at the proper moment by a separately organized force brought into action at a selected place and time, not necessarily in the zone attacked.

The preparations of the Germans for their coming attack were not well concealed.[30] Commencing June 30, the French obtained various sources of information concerning the proposed German offensive.[31]

In carrying out Marshal Foch's directions, General Petain, the French C-in-C, provided strong reenforcements for the entire front from Chateau-Thierry to the Argonne, and on July 3, ordered the headquarters of the Ninth French Army to Provins, with directions to prepare plans against any hostile penetration of the allied line and to be ready to assume command in the area in which penetration occurred.[32] Here again we see a clear division between missions of high commands, two armies in line having defensive zones to defend; one army in rear in reserve, its mission either counter offensive or defense in the open, as circumstances might require.

On July 8, General Petain received a recommendation originating with the Tenth French Army, which was then proceeding with

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[28]French Orders of Battle.
Current maps.

[29]Report, 3d Division, Aug. 5, 1918.
Letter, Col. Kelton, Chief of Staff, 3d Division, July 20, 1918, to General Fox Conner, G-3 at GHQ, A. E. F.
Notes by Gen. Dickman, Commanding 3d Division, on Lieut. Hene's article in the *Field Artillery Journal*, April, 1921.
See also Marshal Foch's instructions of July 10, discussed in following paragraphs.

[30]Ludendorff's *Own Story*, p. 308.
Hindenburg, *Out of My Life*, p. 375.
War Diary, Seventh Army.
Intelligence Reports, Seventh Army.

[31]Summary of Information, GHQ, A. E. F., June 30, 1918, *et seq.*
Guerre de 1914-1918, p. 48.

[32]Letter, French GHQ, No. 3915, July 3, 1918.

operations preliminary to its proposed attack. In this letter the army commander expressed his view that a large serious offensive, made between the Aisne and the Ourcq, would result in the fall of the Marne salient. The commander of the Reserve group of armies approved this view, and the commander of the Sixth French Army (holding the line from the Ourcq to the Marne) suggested that his army, even if not reinforced, could usefully prolong to the south any attack by the Tenth Army.[33]

On the same day this recommendation was received, General Petain formally approved it. He added that an attack by the Tenth Army would be the best means to meet the proposed German offensive, and he ordered that prompt, secret preparations to carry this out be undertaken.[34]

On July 8, General Petain sent instructions to the Fifth and Fourth French Armies, holding the line from Dormans to the Argonne, as to the method of defense to be used by them. The Fourth Army occupied, in Champagne, a strongly prepared defensive zone, and it was ordered to resist along its "intermediate" position, withdrawing its troops from the first line so as to save them from hostile destructive fire, especially that from trench mortars.[35] This order was in accordance with a previous one on tactics in defense, in which it was prescribed that a zone wide enough to include the area likely to be bombarded by the enemy be secretly abandoned.[36] It was also a development of the order of July 1, already discussed, pointing out the relative unimportance of German gains in threatened areas on both sides of Rheims.

The instructions sent to the Fifth Army, whose front, occupied a few weeks only, was not strongly fortified, were to organize in depth and to defend its first position, which was the only one on which considerable work had been done.[37] No instructions as to defense appear to have been issued for that portion of the Sixth Army west of Dormans, along the Marne, and which was not involved in the offensive operations contemplated south of the Ourcq. This, the right sector of the Sixth Army, included the 3rd U. S. Division in first line along the Marne and part of the 28th U. S. Division in reserve near St. Eugene. It would seem that this part of the front threatened with attack ought to conform to the plan of defense ordered for east of Dormans, and the method of defense adopted indicates that this was understood.[38]

[33] *Guerre de 1914-1918*, p. 49.
[34] Letter allied C-in-C, No. 9732, July 8, 1918.
[35] *Guerre de 1914-1918*, p. 50.
[36] Instructions, French GHQ, No. 26,510, Jan. 24, 1918.
[37] *Guerre de 1914-1918*, p. 50.
[38] FO 7, 3d Division, 6:00 p. m., July 2, and annexes issued later, conform in general with the French plan for an elastic defense.

The information received by Marshal Foch by July 10 enabled him to announce that a German attack was imminent, would occur about July 15, and would be on both sides of Rheims as follows:[39]

East attack—between La Pompelle and Massiges, directed toward Chalons.

West attack—from Vrigny (on the Vesle) to Jaulgonne (on the Marne), on both banks of the Marne, and directed toward Epernay.

In fact, the original date of the attack by the Germans, intended for July 20 was changed to July 12, but, to complete preparations, it was again changed to July 15.[40] The information of the allies as to this attack is seen to have been remarkably accurate.

On July 12, additional instructions were sent out by General Petain concerning the defensive, with a view to breaking up the German attack,[41] and four British divisions were thus asked for from the British.[42]

On July 12, General Petain made his decision as to how his command would act in the forthcoming battle. This decision is explained in two letters sent out on this date. In the first of these letters to the commander of the Center Group of Armies[43] he assigned the maintenance of the continuity of the front as the primary mission, then after the enemy had been stopped, to pass to the offensive. If the enemy made a deep penetration this Group of Armies was authorized to use the Ninth Army.

The offensive part of General Petain's plan is explained in part in the same letter to the Center Group of Armies and in a separate letter sent both to the Reserve and the Center Groups of Armies.[44] These letters announced the mission of the offensive as being the reduction of the Marne salient, with a minimum objective of preventing the use by the Germans of the road and railroad communications about Soissons, and freeing Rheims from danger. To carry out this mission the Sixth and Tenth Armies were to attack along both sides of the Ourcq on the west of the Marne salient, and the Fifth Army on both sides of the Ardre on the east of the salient,—the two attacks to be made as rapidly as possible with a view to

[39]G-2, Bulletin No. 9050/XXII, Allied GHQ, July 10, 1918.
[40]Ludendorff's *Own Story*, II, 307.
Message *Ia* 2648, Army Group, German Crown Prince, July 4, 1918.
Letter German GHQ, No. *Ia* 8685, June 14, 1918.
[41]Letter No. 1940, July 11, 1918.
[42]Letter to Marshal Haig, No. 2021, July 12, 1918.
Telegram to Marshal Haig, July 13, 1918.
[43]Letter No. 14,542, July 12, 1918, to the Center Group of Armies.
[44]Letter No. 14,546, July 12, 1918, to both the Reserve and Center Group of Armies.

uniting on the high ground north of Fere-en-Tardenois. To insure surprise, not exceeding four days would be allowed to prepare for the attack, the preliminary order for which might be issued July 14.

The plan outlined in the preceding paragraph was a bold one. It contemplated a strict, but elastic, defensive along the Marne and in Champagne, with no offensive in these sectors until after the German attack had been broken. But on both flanks of the German attack west of Rheims, where a salient already existed, powerful attacks were organized to strike toward the vicinity of Fere-en-Tardenois. If these attacks could unite promptly there was a chance of enveloping, and capturing or destroying, all Germans south of an east-and-west line through Fere-en-Tardenois. Having this mission in view there was probably no particular objection to the Germans gaining some ground to the south of the Marne, as this would increase the probability of their being cut off. Some time would be needed for the Germans to become seriously involved south of the Marne, and the date, July 18, allowed about three days for the German attack to exhaust itself. The success of the plan depended on the defense along the Marne and in Champagne being elastic and not becoming a disaster. Should the latter event become probable, it would be evident before the flank attacks against the Marne salient were launched, and these could then be changed if advisable.

On July 13, Marshal Foch approved the instructions issued on the preceding day by General Petain, at the same time suggesting that as strong a force as possible be used to strengthen the contemplated offensives of the Sixth and Tenth Armies.[45]

At 3:00 P. M., July 13, General Petain telegraphed to the Reserve Group of Armies:

> The attacks of the Sixth and Tenth Armies, referred to in my letter of July 12, must be ready to start on the morning of the 18th.[46]

For the attack the following troops were available on the evening of July 14, in order from north to south:[47]

TENTH FRENCH ARMY

IN LINE

XVIII French Corps
70th French Division
15th French Division

[45]*Guerre de 1914-1918*, pp. 52-3. Marshal Foch directed that as large forces as possible be reserved for the offensive of the Tenth and Sixth Armies.

[46]"*Attaques des 6 et 10 Armees prevues par mon Instruction du 12 Juilet devront etre pouvoir declenchees le 18 au matin.*"
Guerre de 1914-1918, p. 53.

[47]Order of Battle, French GHQ, July 14, 1918.

I French Corps
55th French Division
152nd French Division

XX French Corps
11th French Division
Marine Division (French)

XI French Corps
48th French Division
128th French Division

IN RESERVE

19th French Division
38th French Division
153rd French Division
1st U. S. Division

The Tenth Army was to be supported by six additional divisions,—one American, two British and three French, making eighteen divisions in all, and was to have 470 batteries of artillery, 40 air squadrons, and 375 light tanks.[48] It was to attack without artillery preparations.[49]

On the same date, the Sixth Army had the following troops north of the Marne, available for operations, in order from north to south.[50]

SIXTH FRENCH ARMY

IN LINE NORTH OF THE MARNE

II French Corps
33rd French Division
2nd French Division

VII French Corps
47th French Division
164th French Division
167th French Division
26th U. S. Division

IN RESERVE NORTH OF THE MARNE

168th French Division
4th U. S. Division

[48]Order 227 (1225/3), XX French Corps, July 16, 1918.
Guerre de 1914-1918, pp. 53-4.
[49]*Ibid.*, p. 54.
[50]Order of Battle, French GHQ, July 14, 1918.

IN LINE FROM THE MARNE, INCLUSIVE, EAST

XXVIII French Corps, General De Mondesir
39th French Division
3rd U. S. Division

III French Corps
125th French Division
51st French Division

IN RESERVE SOUTH OF THE MARNE

28th U. S. Division
73rd French Division
20th French Division

The Sixth Army was to be supported by one additional division (American) north of the Marne. For the attack there was provided for this army 230 batteries of artillery, 28 air squadrons, and 170 light tanks. An artillery preparation of one and one-half hours was to precede the attack.[51]

Altogether, for the attack on the west flank of the Marne salient, there was to be available by daylight of July 18:

18 divisions, with
700 batteries of artillery,
68 air squadrons,
545 light tanks.

East of Dormans to Rheims, inclusive, was the Fifth French Army, with a mission at first defensive and latter offensive, subject to the latter duty being assigned to the Ninth French Army, which was moved from Provins to Fere Champenoise, closer to the prospective battlefield. The order of battle from south to north was:[52]

FIFTH FRENCH ARMY

IN LINE

V French Corps
8th French Divisions
40th French Division

II Italian Corps
8th Italian Division
3rd Italian Division

[51] *Guerre de 1914-1918*, p. 54.
[52] Order of Battle, French GHQ, July 14, 1918.

First French Colonial Corps

2nd French Colonial Division
154th French Division
3rd French Colonial Division

IN RESERVE

77th French Division
10th French Colonial Division
120th French Division
7th French Division
71st French Division
10th French Division
5th French Division

No reinforcements appear to have been intended for the Fifth Army, which, however, had strong reserves. We have already noted that on July 13, Marshal Foch had indicated that the offensives of the Sixth and Tenth Armies were to be as strong as possible, and to comply with this requirement additional reinforcements which could yet be brought up by July 18 were sent to the west of the Marne salient. From a transportation point of view, this was the easier side of the salient to which to direct them. Tactically, it offered fairly open terrain for the attack, contrasted with the difficult country, already commented on, southwest of Rheims. Strategically, the concentration of the available means in one sector promised greater gains than a dispersion over two separated sectors.

On the entire front from the Marne salient, inclusive, to the Argonne the allies had available:[53]

57 French Divisions
7 American Divisions
4 British Divisions
2 Italian Divisions

70 Divisions in all

Of these, twenty-seven divisions with the Sixth and Tenth Armies had an offensive mission, and forty-three had a defensive mission. Of the latter, fourteen divisions with the Fifth Army might be used offensively later; the remaining thirty-nine divisions in Cham-

[53] French Order of Battle, July 14, 1918.

pagne had purely defensive missions. Against these forces the Germans had available the following troops:[54]

NINTH ARMY

Fully fit for fighting: 115th, 241st, and 53rd Reserve Divisions.
Fit for fighting after reorganization requiring two to four weeks: 6th, 14th, 15th, 28th, 34th, 46th Reserve, 105th, 211th, 223rd, 14th Reserve, and 11th Bavarian Divisions.
Fit only for defense purposes: 42d and 47th Reserve Divisions.
Total in the entire army: sixteen divisions.

SEVENTH ARMY

Fully fit for fighting: 10th, 22nd, 23rd, 33rd, 36th, 37th, 40th, 50th, 87th, 103rd, 113th, 123rd, 195th, 200th, 201st, 1st Guard, 2d Guard, 10th Reserve, 28th Reserve, 51st Reserve, 12th Bavarian, 6th Bavarian Reserve and 4th Ersatz Divisions.
Fit for fighting after reorganization requiring two to four weeks: 86th, 5th Guard, 3rd Reserve, 45th Reserve, 78th Reserve, and 10th Bavarian Divisions.
Fit only for defense purposes: 10th Landwehr Division.
Total in the entire army: thirty divisions.

FIRST ARMY

Fully fit for fighting: 9th, 199th, 203rd, 239th, 3rd Guard, Guard Ersatz, 8th Bavarian Reserve, 26th Wurtemberg, and 15th Bavarian Divisions.
Fit for fighting after reorganization requiring two to four weeks: 213th, 238th, 242nd, 19th Reserve, and 80th Reserve Divisions.
Total in the entire army: fourteen divisions.

This gives a grand total for the three armies of sixty divisions, to which should be added the ten divisions of the Third Army, making seventy divisions in all, which gives a total number of divisions exactly equal to that on the allied side. The relative strength of divisions is known in part only. The Seventh German Army reports an average strength of 573 men per infantry battalion, which would indicate about 10,000 men per division.[55] The reports of the other

[54] Estimate of Divisions, Army Group, German Crown Prince, July 18, 1918. See also footnotes 19 and 20.
[55] *Op. cit.*

German armies are not at hand. The returns of the American divisions indicate an approximate strength of 24,000 men.[56] The strength of the French, British, and Italian divisions is not on hand. On the whole, it would appear that the Germans were certainly not superior in numbers to their adversaries, and were probably inferior. This must have been known to the Germans as their intelligence service was good. They seem to have relied on supposed superiority of troops in tactics and morale, induced by their earlier successes in the spring and particularly by their latest great battle at the end of May along the Chemin des Dames. Therefore, with full appreciation of the danger of attacks against the flanks of the Marne salient and with urgent warnings of enemy concentrations opposite the west side of the salient, German GHQ decided to proceed with an offensive intended to remove the danger of the Marne salient by capturing Rheims and straightening out the line from the Marne to Champagne, preliminary to a decisive battle to be fought as soon as practicable after the completion of the Rheims operations. They were so confident that, in addition to the Rheims operation, they undertook simultaneously to attack from Rheims as far east as the Argonne to capture Chalons,—a desirable objective but not at all necessary to the capture of Rheims, which was their main mission.

This undue optimism was the ruin of the Germans. Their strength was insufficient to make any substantial gains about Rheims and was still less so in Champagne; while the Ninth German Army, left to guard the flank of the German attack across the Marne, proved fully unequal to stop the foreseen attack made by the allies on July 18. It is well to note that nowhere in the German orders and papers relating to their attack of July 15 is there evidence of any intention of advancing toward Paris. The attack across the Marne was toward the southeast, not southwest, in which direction Paris lay.

On the other hand, we find that the German attack was known in advance by Allied GHQ and that Marshal Foch decided to meet this by a passive defense on the fronts against which the attack would come. Reserves were provided behind these fronts in case any such disaster as happened a few weeks earlier on the Chemin des Dames should again occur. These reserves were not altogether under front-line commanders but were largely retained for possible use under separate commanders to be used in masses. But the main defense was to be a powerful counterattack, made on the west front of the Marne salient at a date to be selected after the progress of the Ger-

[56]Only partial returns of the American divisions are at hand. The 3d Division reports in their War Diary 24,568 officers and men as of July 14. Partial returns of the 1st, 2d and 28th Divisions indicate that their total strength on the same date was about 24,000.

man attack had become known, and which counterattack was carefully prepared for by a series of minor attacks with limited objectives made in order to seize a favorable line of departure for the infantry and to seize woods to conceal a numerous artillery and tanks. With this plan it was only necessary that the troops on the defensive front should hold while inflicting as great a loss as possible on the attacking Germans in order to exhaust their troops and engage their reserves. Losses of terrain, if not too great, were of secondary importance to that of inflicting severe punishment on the enemy. In fact, on the Marne front there was some advantage in leading the Germans across the Marne and thereby increasing their difficulties in meeting the counterattack.

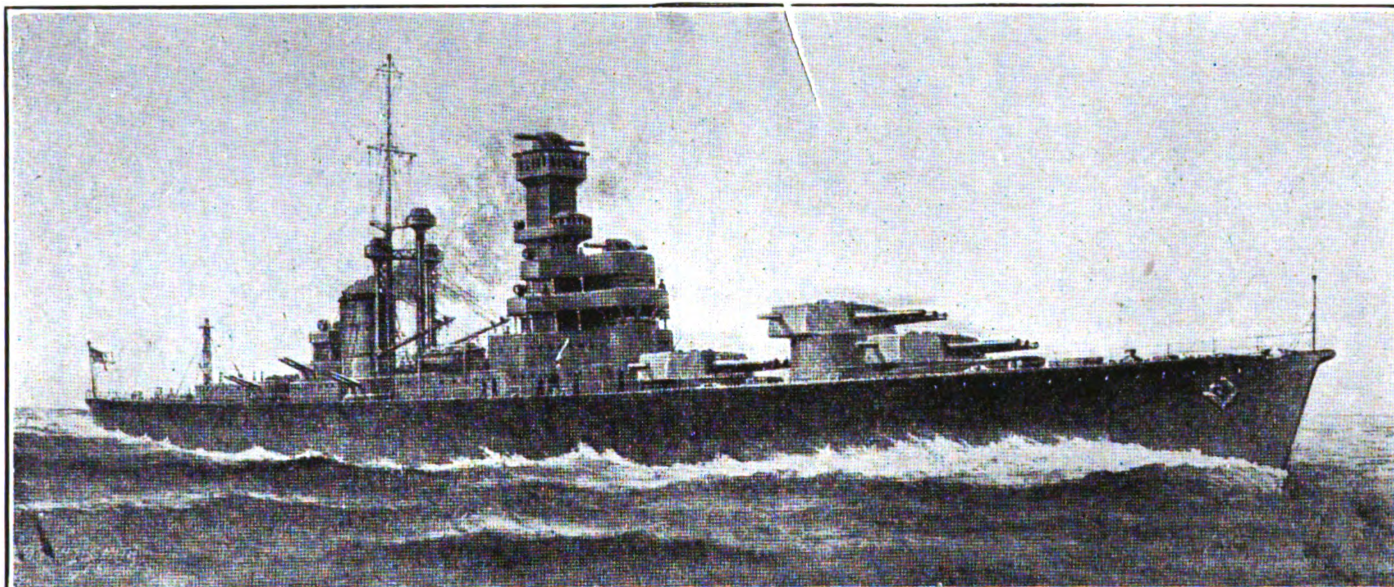
The outstanding feature of the great battle commencing July 15, 1918, is the fact that the commanders on both sides had good information as to the strength, dispositions, and intentions of the other side. Each selected a plan and proceeded to carry it out, while making what he thought was necessary to counter the moves of the enemy. Between the two commanders Marshal Foch won, having correctly gauged the probable success of the German attack against his elastic defense while conserving his main force for the counterattack.

In modern wars between great nations it is probable that, in future, great moves can neither be made nor prepared for without the other side becoming aware of the general nature of what is being done. Good generalship will then rest not only in having a good strategical plan, but in the ability to carry it out against the known general measures taken by the enemy to resist or to counter by a plan of his own in the same or another theater of operations. This will require that any plan of attack shall be adopted only after carefully estimating the enemy reaction as to strength, time, and place. Any error in the estimate may lead to fatal results. The plan must be such that with the means available it will be possible to carry it out. The German plan for their attack on July 15 was not in itself a bad plan, even if it had no great strategical objective. But the available means were insufficient, and the plan was tactically poor. The allied plan to meet the German attack was good both strategically and tactically. Strategically, if successful, it promised to secure valuable terrain with the capture of important German forces in the Marne salient. Tactically, the plan was sound, as the available forces were so disposed as to place a minimum force on the fronts which were not strategically important while preserving a main force on the flank of the German attack where victory promised important results.

The battle, started July 15, 1918, is an excellent illustration of a modern battle and how it is prepared for. The lessons to be drawn are:

a. Good intelligence service—-this is indispensable.
b. Careful estimate of the enemy action as to time, place, and strength.
c. A clear decision which will be practicable as to time, place, strength, and enemy action.
d. Careful preparation to carry out the decision. This does not mean that nothing shall be done until every little detail be worked out. On the contrary, no time should ever be lost to prepare for any plan that it appears may eventually be carried out. Note that the allied counteroffensive of July 18 was foreseen and some preparations started as early as June 7.
e. Secrecy. While it may be impossible to conceal the general preparations made from an active, intelligent enemy, much may be concealed, such as the exact date preparations will be completed, relative importance of preparations at different places, employment of reserves. We have seen, for instance that while the Germans knew of the allied reserves, they wrongly believed they would be directed to strengthen fronts attacked, whereas in reality they were held on a front not attacked for use in a counter offensive.

Our country is founded upon the theory that it belongs to the people, not the people to the state, and differs from all other countries except England in that respect. Our citizens consequently have more individual freedom and rights than those of any other nation. They have need for a greater sense of civic responsibility. They need the restraining influence that comes from military training, its belief in the law of service and cooperation, its respect for the rights of others, its feeling of comradeship, and its proper pride in self and national accomplishment.
—*John W. Weeks, Secretary of War.*



Courtesy of the *Scientific American.*

H. M. S. NELSON

Displacement, 35,000 tons. Length overall, 702 feet. Extreme breadth, 106 feet. Normal draft, 30 feet. Speed, 23 knots. Armament: nine 16-inch guns in three turrets, twelve 6-inch guns in six turrets. Probable armor: turrets, 13-inch; belt, 12-inch.

Last Word on the 5-5-3 Ratio

By J. Bernard Walker

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WE have before us a copy of the recent hearing before a Subcommittee of the House Committee on Appropriations—a volume of 1,000 pages—which contains the most complete data on the Navy that we have ever seen in a document of this character. The Secretary of the Navy and the officers at the heads of departments were subjected to a very searching examination, particularly as to the status of our treaty battleship fleet, and the public is now put in possession of the facts.

The hearing constitutes a complete refutation of the propaganda of the past few years, which sought to persuade the American public that our battleship fleet was far below the standing of five in the Treaty allocation of 5-5-3 to the United States, Great Britain and Japan. The most startling disclosure is that of the enormous range of the guns of the 32,600-ton battleships which would lead our fleet in battle. These ranges are from 34,500 yards to 35,700 yards. So far as we know, this is the first time these figures have been made public, and they constitute a knockout blow to those who have claimed that our fleet is outranged and outspeeded by any other fleet. As a matter of fact, the "boot is on the other leg"; for the extreme range of the latest British battleships is only 24,300 yards, or from 10,000 to 11,000 yards less than that of our leading ships. The enormous significance of this is seen from the following considerations.

It is universally agreed that, as in the great war, so in any war of the future, battleship actions will be fought with the respective fleets drawn up in two parallel lines, or, as it is technically known, "in column." No matter how high may be the speed of individual ships, the speed of the whole column as such will be governed by that of the slowest ship in the fleet. This speed is about the same in the two fleets, the slowest American ship being credited with a speed of 20.5 knots and the slowest British ship with a speed of 21 knots. It is probable that, in the unlikely event of a naval battle between us and the British, the two fleets would settle down to a speed of about 20 knots. The British line includes five 25-knot ships and four battle cruisers credited with speeds of 29 to 31.5 knots.

Whatever might happen during the approach of the two fleets, it is certain that when they fell into line for the great test, these faster vessels would have to hold their speeds down to the fleet fighting speed of 20 knots.

If the weather is clear, and we will suppose it is, and if airplane and general scouting information has been ample and correct, the two fleets will deploy into column before they come within range. Thereafter they will approach each other on more or less converging courses. Now let us see what would happen. The head of the British

CAPITAL SHIPS OF THE UNITED STATES

Name of Ship	*Turret Guns*		*Maximum Angle of Elevation in Degrees*	*Range in Yards*	*Speed in Knots*	*Displacement in Tons*
	Diameter of Bore in Inches	*Length in Calibers*				
West Virginia	16	45	30	34,500	21.2	32,600
Colorado	16	45	30	34,500	21.4	32,600
Maryland	16	45	30	34,500	21.1	32,600
California	14	50	30	35,500	21.7	32,300
Tennessee	14	50	30	35,700	21.4	32,300
Idaho	14	50	15	24,000	21.3	32,000
New Mexico	14	50	15	24,000	21.1	32,000
Mississippi	14	50	15	24,000	21.1	32,000
Arkansas	12	50	15	24,350	21.1	26,000
Wyoming	12	50	15	23,500	21.2	26,000
Arizona	14	45	15	21,000	21.0	31,400
Pennsylvania	14	45	15	21,000	21.1	31,400
Oklahoma	14	45	15	21,000	20.6	27,500
Nevada	14	45	15	21,000	20.5	27,500
New York	14	45	15	21,000	21.5	27,000
Texas	14	45	15	21,000	21.0	27,000
Florida	12	45	15	22,000	22.1	21,825
Utah	12	45	15	21,600	21.0	21,825
Grand Total						525,850

line, containing their latest ships of the *Royal Sovereign* class, would come under the fire of the head of our line at a distance of over 17½ miles, or at a distance where their own 15-inch guns, firing at maximum elevation, would drop their shells 10,000 to 11,000 yards, or 5 to 5½ miles, short of the American line. They would not dare to come in end-on, because in that position they would be raked by our salvos, and in spite of the dispersion of the falling shells, a single eight-gun salvo might drop from three to half-a-dozen shells upon the deck of any ship thus approaching. Hence, the approach would be made on a converging course, and instead of 15 minutes it would take some 25 minutes or more for the British to get within range. During all that time they would be exposed to heavy shell fire of a most devastating character to which they could make no reply. With our system of fire control, and assuming airplane spotting to be possible,

it would be possible to drop between 1,000 and 1,200 shells upon the leading ships of the British line before they could get in close enough to return our fire.

It is surely no exaggeration to say that, under existing circumstances, if our fleet were able to maintain airplane spotting, the head of the British line would be crumpled up and either severely crippled or put entirely out of the fight before getting within hitting range.

CAPITAL SHIPS OF THE BRITISH NAVY

Name of Ship	*Turret Guns*		*Maximum Angle of Elevation in Degrees*	*Range in Yards*	*Speed in Knots*	*Displacement in Tons*
	Diameter of Bore in Inches	*Length in Calibers*				
Royal Sovereign	15	42	20	24,300	21.6	25,750
Royal Oak	15	42	20	24,300	21.5	25,750
Revenge	15	42	20	24,300	21.9	25,750
Resolution	15	42	20	24,300	21.6	25,750
Ramilies	15	42	20	24,300	21.5	25,750
Malaya	15	42	20	24,300	25.0	27,500
Valiant	15	42	20	24,300	25.0	27,500
Barham	15	42	20	24,300	25.0	27,500
Queen Elizabeth	15	42	20	24,300	25.0	27,500
Warspite	15	42	20	24,300	25.0	27,500
Hood	15	42	80	30,800	81.5	41,200
Renown	15	42	20	24,300	81.5	26,500
Repulse	15	42	20	24,300	31.0	26,500
Tiger	18.5	45	20	28,800	29.0	28,500
Benbow	18.5	45	20	23,800	21.5	25,000
Emperor of India	13.5	45	20	23,800	21.5	25,000
Iron Duke	18.5	45	20	28,800	21.6	25,000
Marlborough	18.5	45	20	28,800	21.6	25,000
Thunderer	18.5	45	20	28,800	21.	*22,500
King George	13.5	45	20	28,800	21.4	*23,000
Ajax	13.5	45	20	28,800	21.1	*23,000
Centurion	13.5	45	20	23,800	21.9	*23,000

Grand Total 580,450

* These four to be scrapped when *Nelson* and *Rodney* are completed, when total will be 558,950, against United States 525,850; the extra tonnage allowed to offset greater age of British Fleet.

As the fleets continued to close in, the British with a range of 24,300 yards, and the next five of our ships with from 23,500 to 24,000 yards, would engage each other. At this time our eight older ships with 21,000 to 22,000 yards range would be outranged by the opposing British ships by from 1,800 yards to 2,800 yards. Our own line, of course, would close in until these older ships could reach the enemy; but for several minutes the tail end of the British line would have the advantage of ours. But this temporary advantage of the enemy over our older ships, which would last for four to six minutes, would not compensate for the fact that for 25 minutes at the commencement of the action the best ships of the British line

had been subjected to an overwhelming gun fire to which they could make no reply.

The British line would include four battle cruisers, of which the *Hood* alone, with guns of 30,300 yards range and 12-inch armor, could stand up to the fire of the 14-inch and 12-inch guns of our older ships. The other three, *Renown*, *Repulse* and *Tiger*, with only 9-inch armor, would probably share the fate of the three battle cruisers that were sunk by 11-inch and 12-inch gun fire early in the battle of Jutland.

It is for these reasons we are satisfied that the American public, on looking at these two tables and the sketch* prepared by our artist showing the approach of the two fleets, will agree with us that, far from our fleet being outranged, and outspeeded, we ourselves have the whiphand, and with equal gunnery and equal seamanship could very reasonably count upon a sweeping victory.

And let it be clearly understood that if the proposed elevation of all guns of our fleet to 30 degrees were followed out, not merely our "big five" but our whole fleet of 18 ships would have the enemy under fire for from 15 up to 25 minutes before he could reach us. Such a change would vitiate the nice balance which was determined upon between our officers and those of the British in the selection of the respective battleship fleets, and would place us at an enormous fighting advantage.

It was brought out at the hearing that, with the exception of the *Florida*, the boilers of the ships which had to reduce their speed in the Panama maneuvers had been repaired and that these ships can now make their trial speeds. The *Florida* is in port for similar repairs.

In conclusion, there are two duties which confront the United States—first, to grant, without any reduction, the appropriations asked by the Navy Department for repair work; and secondly to bring our fleet up to Treaty strength in unarmed cruisers, fast scouts, airplane carriers and such vessels as are not limited by Treaty.

* Not reproduced.

The Past and Future of Defense Against Aircraft

By CAPTAIN BENJAMIN F. HARMON, C. A. C.

PRIOR to the World War the pages of this and other publications devoted considerable space to the then debatable question: "Is the dirigible or the airplane of military value?" Aircraft were stripped and laid bare in all their weaknesses or presented in all their strength according as the opinion of the writers varied. That question is no longer debatable. The answer has been written in the pages of history. New questions have arisen in the press of the present day and considerable heat is being generated on both sides of the well known "*vs*"—the airplane *vs.* the battleship,—the airplane *vs.* the seacoast gun,—etc., etc. In every case the correct answer would be found and considerable benefit would result from a total elimination of the "*versus*" and the substitution therefore of the phrase "in cooperation with." Thus, in antiaircraft instruction no "*versus*" is permitted. We say to the Air Service, figuratively: "Your pursuit planes are the best defense against hostile planes by day. We will support you at all times and act alone in your absence." The spirit of cooperation is one of the principles of war.

As a result of these current discussions a considerable number of people are losing all sense of proportion. This is to be regretted equally if the value of the Air Service be under-estimated or over-estimated. Inasmuch as the value of antiaircraft defense varies directly with the value of the Air Service let us examine, briefly, some of the factors which determine that value.

We begin with one incontrovertible fact which all the developments in the art of war have not altered—wars are won when our forces strike the enemy forces with such power that his will to resist and to fight is broken down. The doughboy does the striking. Artillery, Cavalry, and Air Service are ancillary means to the building up, preparing, and delivering of that blow. Infantry troops attempting to operate without artillery and air service support would have the most difficult, if not insurmountable, obstacles to overcome. Success in battle is often made possible by the artillery and air service—but is not accomplished by them directly. Wars cannot be won at long distance by artillery or from the air, but by the actual

physical contact of our infantry with that of the hostile forces. It is pertinent to inquire into the role of the Air Service in this scheme.

First the mission of reconnaissance. From the air we observe the location, size, and direction of march of the hostile units. We are thereby enabled to make our plans and to avoid tactical surprise while assembling and maneuvering our forces according to the plans we have made; for example, to attack the enemy who is in strength, position, and has probable intentions as determined by that reconnaissance. The mission of reconnaissance never ends. Formerly the information so obtained could only be determined usually by actual combat; for example, by a force sent against the enemy not sufficient or intended to defeat him, but of sufficient strength to cause him to deploy his units and thus expose by fighting the number and disposition of his troops.

The enemy on his part has certain means of decreasing the power of our attacking blow. Against these means the Air Service must act so that our power may be maintained greater than his. His artillery must be put out of action and the ammunition therefor destroyed. Attack and bombing planes are assigned this duty. Furthermore, artillery planes act as eyes for our artillery units and enable them to engage and destroy the same targets.

The Air Service must act directly to decrease the fighting power of the enemy forces. Destroying supplies, the means of bringing them up (trains, roads, railroad bridges), or their place of manufacture, assists in accomplishing this object. Attacking the enemy forces directly or bombing his cities in addition to reducing the material power of the enemy to fight reduces his morale or his will, which works to the same end.

The foregoing are offensive missions. We must not lose sight of the enemy's attempts to accomplish the same results with his Air Service. We must prevent him from so doing by the attack of our Air Service against his and by the action of our antiaircraft troops. These latter are defensive missions.

This resumé is brief but sufficient to show the great importance of the roles played by the Air Service. Remember at the same time that the only unit of vital importance is the infantry, which alone is the ultimate factor in winning a battle. We must maintain the proper sense of proportion.

Before passing from this subject it would be well to illustrate the importance of Air Service roles, particularly reconnaissance, by reference to the opening phases of the World War. What changes in the history of the world would have been effected by the use of an efficient air force up to the First Battle of the Marne? No one knows,

of course; but it would seem that the following phases would not have terminated as they did.

(a) The German Sixth and Seventh Armies would not have attempted the penetration of the Charmes Gap between Epinal and Toul, thus permitting the French First Army from the right and the second Army from the left (concealed in the Grand Crown of Nancy) to attack them in flank and throw them back in defeat on August 25, 1914.

(b) The German Fifth and Fourth Armies and the French Third and Fourth Armies would not, probably, have engaged on August 22 in the meeting engagement of the Battle of the Ardennes, or, having accepted engagement, the German forces would not have been surprised in their pursuit by the flank attack of General Manoury on August 25.

(c) Von Moltke would have known before September 3 of the French concentrations near Paris and probably would have altered his scheme of operations.

(d) The true state of affairs on the allied left would have been known better to the Germans who would not have abandoned the von Schleiffen plan of passing to the west of Paris with their First Army in favor of passing to the east, thus walking into Marshal Joffre's trap between Paris and Verdun and precipitating the great Battle of the Marne, an allied victory.

This divergence into the realm of conjecture would appear to indicate that airplanes properly used would have changed the history of the war and of the world, but such is not the correct conclusion even if the hypotheses are correct. The reconnaisance theoretically obtained by those planes would have placed in the hands of the infantry the ability to do or prevent certain things, which might have altered history very materially.

This is rather an indirect proof of the value of defense against aircraft, but if the value of aircraft in the military scheme has been shown, then the value of defense against aircraft has been indicated equally, for the two are inseparably inter-dependent. We are justified in expending for defensive measures, in time, money and materiel, in exact proportion to the losses we might incur by permitting an enemy air service unhampered action.

The means of defense against aircraft are innumerable. Foremost of all these is the pursuit plane that can seek the enemy whereever that enemy may decide to fly. Why go further? Because the pursuit plane like any other machine or weapon has its limitations. It must *see* the enemy before it can attack; and darkness, fog, clouds,

and rain interfere frequently. It must be present in sufficient numbers and at sufficient altitudes to engage all enemy planes. Manifestly over an extended theater of operations this condition is humanly impossible of fulfillment.

At this point the much disputed "control of the air" should be discussed. "Control of the air" is an ephemeral property which an army has today and loses tomorrow. It can be obtained or lost by the same means that Napoleon obtained control by battle. Napoleon, having 20,000 men, for example, would attack a force of 30,000 men and attack with a preponderance of men by the simple expedient of attacking only 15,000 of the enemy at a time. Thus, two forces, Red and Blue, are opposed on a hundred-mile front. Red has 2000 planes and Blue 1000. Has Red Control of the Air? Blue decides to attack or carry out some operation on a certain 25-mile front and secretly concentrates there 500 of his 1000 planes. He appears with 500 against Red's 100 and has control of the air in the vital sector when totally he is outnumbered two to one. There will be times when the Air Service will need help during, before, and after combat, and times when, for some of the reasons enumerated, our air force cannot attack, in which eventualities the antiaircraft units will cooperate and assist or bear the entire defensive burden as circumstances warrant. It is not possible to oppose every enemy plane with another plane — recall the ratio of hostile planes seen in France to the number of aerial combats noted,— but it is possible and essential that no hostile plane shall approach an objective, whether materiel or body of troops, without being brought under fire.

Means of protection against aircraft operated from the ground are *defensive* because they cannot seek out the enemy where that enemy's will takes him. Part of them may be considered as having an offensive defense because they seek out and engage any plane within a certain radius and others as strictly defensive because they are inert and have no value unless attacked.

Of the defensive means perhaps that of camouflage is best known. Camouflage works both ways. It may conceal from enemy eyes the existence of materiel or troops, or it may lead the enemy to assume that certain batteries or other units exist at points where actually they do not. Nature has created camouflage for us; that is, in woods and forests we have sufficient overhead cover which cannot be penetrated by the eye. We wish to permit men to go from a certain battery to their dugouts. Walking through grass would create paths soon detected by aerial photographs. However, an old trench extends from near the battery position to the dugout. This old trench already photographed will be utilized as a path for pro-

tection from the air. Even a judicious selection of paths is a defense against aircraft and such considerations come under the head of camouflage.

In storing supplies, particularly ammunition or explosives, the total is subdivided and separated so that the radius of destruction resulting from a single bomb is limited to one subdivision. This is a defense against shellfire and accidental destruction as well as aerial bombing. Sandbag parapets or similar walls serve to stop the lateral travel of bomb fragments and thus protect personnel or materiel from all but a direct hit. In a well-organized French airdrome near Verdun each bed in the aviators barracks was completely surrounded by such an "*eclat* wall."

Barrage balloons form a very effective night defense for small targets such as railroad bridges or individual buildings in a city. This balloon, of a type similar to the kite observaton balloons, but smaller, is effective in a moral as well as a physical sense. That is, the group of defensive balloons must be raised in such positions that the attacking plane is compelled to fly through them to bomb successfully the area protected. Should the balloons be visible to the attacking aviators the presence below those balloons of invisible cables exerts an extremely deterrent force on the aviator's will to pass. It is impossible to estimate the location of the cables, and one of several decisions must be made.

First: To avoid the spot altogether. This was by no means unusual in the World War.

Second: To encircle in search of an opening. If the target is so large that open spots must be left, then these should be covered by a concentration of fire or night pursuit planes.

Third: To climb above the balloons. If the attacker be at a lower altitude and if he be a heavily loaded bomber, his attempt to delay in the presence of enemy fire, searchlights, and possibly night pursuit planes for a sufficient length of time to enable the climb to be made will result in all probability in his own destruction. The efficacy of the balloon presupposes that it be raised above the attacking altitude. This height can be made so great that night bombing from above it at a small target has a minute probability of hitting and the height can be made greater than the ceiling of most bombers.

Fourth: The balloons may be shot down. By the bomber this is practically impossible even should he be at the proper altitude. Balloon engagement is a fine art limited to the highly maneuverable fighting planes. It is possible that such planes might destroy the

balloon defense before the arrival of the bombers, provided they could see the balloons at night.

Fifth: The attackers can fly through the barrage of wires either intentionally or in ignorance of their existence. Here the physical effect enters. The plane, colliding with the taut wire, is destroyed. There are several records of such destruction occurring in the Calais region. The plane may be fortunate and penetrate the wires successfully. The measure of that probability is the ratio of distance between wires to wing span.

The barrage balloon found another use in creating a barrier across well known paths of approach for night-flying planes. These barriers were used in the hope that they would cause the actual destruction of planes or cause them to be lost in circling.

Smoke, generated by combustion or by chemical processes, is utilized to blot from the aviator's sight certain well-defined landmarks or targets either by day or by night. At this point the question is invariably raised, "Does not the smoke itself attract the aviator?" The answer is discovered in the use of the words "well-defined" immediately preceding. Smoke concealment is attempted only where the object concealed is otherwise plainly discernible. There are two general cases. First, it is desired to blot out some landmark utilized as a guide by a hostile aviator to enable him to reach his target. Whether a smoke screen over that landmark would be visible and thus disclose the landmark indirectly depends on existing conditions of visibility. If necessary a repetition of the smoke screen at other points along the route should throw sufficient doubt in the aviator's mind to assist him in getting lost. Second, it is intended to protect a munitions factory which, by reason of its location on a river at a certain point or for some other condition of visibility can be readily found from the air. By covering the entire region with smoke we admit the presence of the factory—since it is futile to deny it—but we conceal its *exact* location and the bombing must be by guess work. The greater the area covered by the blanket of smoke, the greater is the chance of the factory escaping destruction. The use of smoke has the disadvantage of depending upon wind for its efficacy. In too high a wind the cloud is dispersed rapidly, and in too slow a wind it is difficult to cover a sufficient area. Smoke was used to a large extent by the French for the concealment of bridges, factories, and buildings in the Paris region.

The same effect can be obtained by the use of inverted illumination, usually referred to as "luminous camouflage." Here a large zone containing the sensitive spot requiring protection is ruled off in one-kilometer squares. At each corner of these squares is placed

a 20,000 candle-power source of light—electric or magnesium flares—in an inverted 45° reflector. The appearance to the aviator is a sea of light within which his target lies; but its exact location is impossible of determination. If the attack be made within machine-gun range, the plane may be illuminated sufficiently to permit fire—or at least the aviator may imagine himself plainly visible to the ground, in which case he may decide that too great publicity is not to be desired and leave. There is the further possibility that an attacking bomber will be silhouetted against the light to a night pursuit plane above him, thus enabling an attack to be made by that pursuit plane. A project of this nature requires a large, expensive plant and therefore will be unsual.

Lights have also been used in a manner analogous to the utilization of barrage balloons, this type of defense being termed a "luminous barrage." Searchlights are established to create an inclined wall of light through which attacking planes must pass in order to reach a certain target. In passing through this stationary illuminated zone the attacker comes under the concentrated fire of guns and machine guns or perhaps attack planes lingering behind the barrage. This defensive conception arose at a time when searchlights were not producing the desired results. It is thought that development of seachlight materiel will obviate the necessity for any other scheme than the normal, direct searchlight action.

Measures taken for the protection of civilian communities come under the scope of antiaircraft defense and under the direct jurisdiction of those troops. These protective measures include a thorough surveillance organization to detect far in advance the approach of an attack, the necessary communications system to insure the immediate transmission of intelligence from the surveillance system, and the means and power for enforcement of the obscuration of all lights. It includes the supervision of the organization of bombproof and dugout construction and, finally, the education of the populace in the necessity for their loyalty in carrying out all the details of defensive measures and maintaining that high morale which the people at home must have if their army is to be victorious.

The antiaircraft means of defense suggested and tried out are legion. The foregoing are those that have had a measure of application and are still considered as factors to be weighed in planning an antiaircraft defense. The backbone of any defense will always be those weapons that have a striking power—that we have called offensive-defensive weapons; namely, searchlights, guns, and machine guns.

Searchlights are advisedly classed with those defensive means having a striking power. It is true that the power exerted is in a

moral rather than a physical sense, but none the less positive. The difficulties in the path of an aviator making a long-distance night bombardment are innumerable: the actual control of his plane is more difficult; the landmarks are hard to discover and easy to lose; the entire course is difficult to follow—he knows not what is going on about him. Suddenly he is picked up by a group of searchlights and feels himself, in consequence, to be the most prominent object in his enemy's territory. He is a target for guns, machine guns and pursuit planes; his objective cannot be seen; his landmarks disappear; and he is obsessed with an all important problem—to escape from the beam.

The development of the searchlight was greatest with the British, and from them the A. E. F. took its first lessons. The British conception of searchlight tactics differed essentially from the French in that the British developed night pursuit aviation to reinforce the effect of the light itself. In the summer of 1918 they maintained between Cambrai and St. Quentin a special group of fifty-three searchlights and twenty-six pursuit planes established in four lines at intervals of about three kilometers. This organization accounted for twenty German night bombardment planes that summer. Their defense of London was organized in alternate zones of airplane-searchlight and gun-searchlight activity.

The A. E. F. searchlights were operated by the Corps of Engineers. Both in point of operation and research these special troops accomplished all that could be expected. They were hampered, like all antiaircraft units, by the lack of suitable materiel at that stage of the development of a new science. It should be borne in mind that the searchlight frequently operates under heavy fire. In proportion as the light gets the aviators "wind up" that light is liable to bombing and machine gunning by the plane. This is a bit rough on the light crew, but this is the purpose for which they exist. Every bomb dropped, every foot of altitude given up, every second wasted in attacking the light, operates to protect the area behind that light. It accomplishes its mission by being a target—and in addition tends to draw the attackers within machine gun range.

As the intensity of night bombing increased, the interest in sound apparatus was intensified. The sound locator has two functions to perform; first to direct the searchlight on the present source of the sound, and second to enable the guns to fire at a future point where plane and projectile will meet.

There are two general auricular methods of determining the apparent location of a source of sound: one based on difference in intensity, and one based on difference in phase. In the first method

the observer has, for example, a conical trumpet, the small end of which is connected to his ears by a tubing arrangement. This he revolves until the sound has a maximum intensity in his ears at which time he is pointed at the apparent source of sound. In actual operation the apparatus is oscillated about the apparent maximum (both in elevation and in azimuth) and the mean of the oscillations considered as the determined value. The principal objection to the maximum apparatus is that the sound arrives in varying intensities due, no doubt, to the non-uniform transmission of sound through air pockets and other variations in air density.

To visualize the method of difference in phase, consider a man facing an apparent source of sound. To his unaided ears the sound appears *in front*. Should he turn his head to the left the sound then appears *to the right*, and upon turning his head to the right the sound appears *to the left*. Should be then swing his head slightly so as to receive successively the sensation of sound to the right and to the left, the true direction of the sound in front will be found by bisecting the amplitude of the swings from right to left. Apparatus designed on this principle augment the range and accuracy of the unaided ear and permit of a more exact determination of angular readings, as well as adding the ability to sense a direction in elevation equally well with the azimuthal determination. Perhaps the best known of this type of apparatus is the paraboloid sound reflector—which was used also as a maximum apparatus. The focusing property of a paraboloid needs no description. The two most successful of the paraboloid apparatus were two and three meters in diameter with a 70-cm. and a 1-meter focal length, respectively. At the focal point were placed two sets of small trumpets, one for azimuth and one for elevation, connected by tubes of equal length to the ears of the two operators. In accepting the paraboloid, the French based their acceptance on the following inherent advantages:

1. The sound is intensified and the range increased. In calm weather ranges of fifteen kilometers have been attained.

2. It is not affected by wind.

3. Parasitic and external noises do not interfere. Sounds (gunfire, trucks, etc.) more than 30° from the source of sound do not interfere, and the selectivity in following one of several planes is about two hundred mils.

The magnitude of the oscillation necessary to produce the passage of the sound from right to left was very large. This was partially compensated for by a mechanical index which remained practically at the center of oscillation.

The progress of the experimentation in the development of sound apparatus presents a most interesting study of which the account contained herein is an extremely brief outline. It is impossible to do justice to the entire subject and still consider other phases of antiaircraft development in an article of this length.

Reference has been made to the apparent source of sound. Sound travels through air at a rate of about 363 yards per second. Thus it would take eleven seconds for sound to reach the ear from a plane four thousand yards distant. During that time the plane will have traveled 550 yards (assuming a speed of 50 yards per second) so that the apparatus would determine an apparent source of sound 550 yards behind the actual or present source. To this lag of sound must be added the effect of wind and temperature on the sound wave, and corrections applied for all these determining conditions to deduce from the apparent position the present position of the source of sound. On this present position the searchlights may open, but additional computations are necessary for artillery fire. Some prediction system was necessary in order that the travel of the target during the time utilized in serving the guns and the time of flight of the projectile might be computed.

Three elements must be determined: the altitude of the target; its predicted azimuth; and its angular height, i.e., the angle formed by the line of sight and the horizontal. From these values the predicted elevation of the gun and the fuse setting may be determined. If a graph be constructed of concentric circles having for radii the cotangents of the various angular heights and with radial lines of true azimuths, then the apparent source of sound as determined by the sound apparatus may be plotted thereon, inasmuch as that apparatus determines an azimuth and angular height. Now it can be shown that a succession of points so plotted will be a reproduction of the horizontal projection of the plane's flight to a scale 1/H (H-altitude). If a length of this plot and the time taken in producing that length be measured, then the altitude may be computed. Furthermore, a slide rule may be constructed that will permit the extension of the plot as determined by three separate factors; first, lag of sound and wind and temperature effects on the sound; second, travel of the target during service of the piece; and, finally, travel of target during the time of flight.

The formulæ arrived at for this prediction are empirical. Approximations are made throughout, and the entire system is based on the operation of a non-precision instrument. The prediction cannot be considered except as unsatisfactory and inaccurate—but it was the best method of night fire available. A future point was de-

termined. Should we fire a rifle, figuratively, at this point, no results would be likely. On the other hand, should we fire a number of shotguns a different story would be told. The predicted point is not exact, but the chances are very high that several 4-, 6-, 8-, or 10-gun batteries firing at that point will include in their dispersed volume of fire the true position of the target. By volume of fire inaccuracies are compensated for. A two-gun battery is of little value for night fire.

What results were accomplished by night firing? In the defense of Dunkirk there existed a specially developed sound organization that accounted for four Gothas in one month (July, 1918). It was about Paris, however, that great results were obtained. Paris is the heart of France and, as such, was not stinted in the materiel made available for its protection. Its antiaircraft guns ran into the hundreds. Smoke screens, alert signals, surveillance lines, listening posts, machine guns, searchlights, bomb proofs, and other defensive means, in materiel and personnel alike, composed an extremely large, efficient, and well-organized plant. The results of this defense are known to a relatively small number of people, but to those who have made a study thereof, it exists as one of the great achievements of the War. Operating under the most difficult conditions against the fleetest of all targets, a measure of defense was given by the A. A. organization far beyond all reasonable hopes and expectations. In 1918, but seven percent of the attacking planes passed the defense and reached Paris. Thirteen night bombers were destroyed. Most significant of all, perhaps, is the fact that in one raid (Aug. 15-16, 1918), eleven thousand kilograms of bombs were destined for Paris, whereas during the entire year, only half that weight was actually dropped on Paris.

The development of night firing methods was due to and parallel with the development of the night bombardment plane which culminated, specifically, in the Gotha. Day firing methods preceded the night-time defense in point of development. At the beginning of the war one saw an occasional Taube and fired at it with an ordinary field gun—if at all. Reconnaissance was, at that time, the all-important air mission, and that such reconnaissance was ineffective is well brought out by General Von Kluck's account of the march of the First Army on Paris in 1914. He suffered continually from a lack of true information regarding his opponents. Repeatedly he was reduced to the merest conjecture as to the location of the entire British Expeditionary Forces. Today, due to the tremendous strides in the science of aviation, such a condition would be impossible. From a small and very ineffective reconnaissance service the Air

Service had developed at the end of the War to a large force performing effectively the missions of pursuit, bombardment, reconnaissance, and attack. As the aerial weapon increased in value greater stress was placed on antiaircraft defense; as that defense increased in efficacy the planes increased their effective operating altitudes. Thus we have an interesting parallel development of attack and defense during the period of hostilities when theories and conjectures did not enter. The attack of the airplane was a fact and a defense against it worked or it didn't—another fact.

The termination of the war found in each of the allied armies a recognized corps of artillerymen in charge of development and training in the difficult and extremely technical art of delivering accurate fire against an airplane. The French antiaircraft service claimed one-fourth of the total planes destroyed in 1918—having been developed to this point from a condition of non-existence in 1914. The difficulties to be overcome in accomplishing such results were enormous.

Consider an airplane with a speed of 50 yards per second (about 100 miles per hour). It would require 120 seconds for this target to travel 6000 yards. It takes 20 seconds for the 75-mm. projectile to travel the same distance—the projectile has but six times the speed of the target and that target very slow as airplanes are now considered! Suppose, then, that the target is 6000 yards from the battery—20 seconds away. We can determine exactly where he is now, but his location at the end of 20 seconds is a matter for conjecture. Actually he can be anywhere within a volume about one million times the danger volume of the projectile fired at him. In other words, the mathematical probability of a hit is one in one million. Consider, for a moment, the actual number of planes *destroyed* by A. E. F. gunners (destroyed in contradistinction to *hit;* planes may be hit repeatedly, and were hit, without destruction) in contrast with this probability. Of all the American batteries firing, one plane was destroyed for each 1050 rounds fired. Those batteries that actually brought down planes made a record of one every 604 rounds, and one battery shot down two planes with its first 120 rounds. Why these remarkable results when the mathematical probability is one in one million?—*To be concluded.*

An Outline of Industrial Mobilization

EDITOR'S NOTE: *The following paper, prepared in the Office of the Assistant Secretary of War, sets forth briefly some of the salient features of the measures required in time of peace to insure the flow of ammunition and supplies needed by our Army in the event of war. Although this paper has already appeared in mimeographed form, it is here reprinted because of the great importance of the subject, and because of the clear and concise manner in which the problem and its solution is presented.*

THE National Defense Act, as amended June 4, 1920, establishes the broad outlines of a military policy for the United States. Under the provisions of this law the Army of the United States, consisting of the Regular Army, the National Guard, and the Organized Reserves, is at present organized, trained, administered, and supplied. Congress, in amending the National Defense Act, made a fundamental change in the business organization of the War Department. The Assistant Secretary of War, under the supervision of the Secretary, is now charged with the control of policies affecting the business administration of the Army.

The duties of the Assistant Secretary of War are defined in section 5*a* of the National Defense Act. As prescribed therein, he has two distinct functions: first, he is responsible for supervising the procurement of all military supplies by the War Department and other duties relating thereto; second, he is required to see that adequate provision is made for the mobilization of materiel and industrial organizations. The statute says he shall be charged with "The assurance of adequate provisions" for industrial mobilization, but this must be taken to mean that he is responsible that adequate plans are made.

Wars are no longer fought by the armed forces alone. Every man, woman and child, every resource, and every dollar in the entire Nation must throw its weight toward victory in time of war. Industry alone can not win a war, but it can lose a war by failing to supply the armies with munitions, vital to their fighting efficiency.

In planning for procurement of supplies in time of war, it is, of course, necessary to know what kind of supplies will be required and how much will be needed. The General Staff indicates to the Secretary of War the military program which is believed adequate for any emergency and determines the types of equipment and tables of allowances. All questions affecting the procurement of supplies—that is, where they can be procured, who will procure them, the rate

of production, and maintenance of an economical program — are determined under policies laid down by the Assistant Secretary of War, the business head of the War Department. The cost of the supply program must be estimated in order that Congress may know the extent of appropriations required and the Treasury Department may have the necessary data upon which to make plans for financing the war.

In this connection the War Department is giving most careful attention to the ways and means whereby profiteering may be controlled in time of war. The principle that men at home shall not make inordinate profits from war, while their fellows are staking their lives and their health for their country, is fundamental as a proposition of common justice. Such a policy was affirmed in a nation-wide referendum by the Chamber of Commerce of the United States during the World War, and has been repeatedly commended as a principle of government. It may, therefore, be regarded as a fixed national policy for the future.

An army requires hundreds of thousands of items of supply, many of which are of a special design not produced commercially in time of peace. Before the War Department could approach industry in order to discuss production, it was first necessary to standardize specifications for supplies wherever practicable. This has been done by adopting, as far as possible, commercial standards, thereby insuring quicker production and reduced costs. At the same time it has reduced the large number of contract forms previously in use to three forms which are about to be adopted for all war contracts. The adoption of such a simple form should obviate many of the mistakes made in the World War by inexperienced buyers for the Government.

Plans for procurement do not stop with the determination of the finished article, but the War Department must go further and plan for the procurement of machines for the making of its materiel, for securing the necessary raw materials which might become critical in time of war, and for insuring an adequate supply of labor, of power, and of transportation facilities.

This phase of procurement planning goes beyond the strictly military features and merges into the broader field, which for want of a better term has been called "Industrial Mobilization." By this term we mean the conversion of the Industrial effort of the Nation from peace production to war production in an orderly manner, so that supplies can be furnished promptly, economic losses minimized, and the return to normal economic conditions at the conclusion of the war facilitated.

In order that these plans may be complete, it is necessary that the war requirements of the Navy, shipping, the railroads, and of the civilian needs be considered. Cooperation with the Navy will be accomplished by the recently created Army and Navy Munitions Board. It will be necessary, in time of war, to create an agency similar to the War Industries Board to coordinate the civilian demands with those of the Army and Navy.

The following indicates the steps which are being taken in working out a plan for the procurement of supplies for the War Department in time of War:

First. Having determined what will be required, it became necessary to figure out how much would be required. This necessarily depends upon the tables of allowances and the mobilization rate, which rate also determines when the supplies will be required.

Second. Having worked out in detail the amount of supplies required, it then became necessary to determine where and how they could be procured. This has been done by the establishment of procurement districts by each branch of the War Department, to each of which has been apportioned a proper share of the total requirements. In order to prevent competition among procuring branches, facilities requested by them have been tentatively allocated for the purpose of procuring the supplies required. The officers in charge of procurement districts are engaged during the present year in making a survey of establishments required to meet the supply program.

There are seven supply branches in the Army. The Quartermaster Corps is responsible for the procurement of all subsistence and forage, all clothing, personal equipment, tentage and general equipage, fuel, oil, paints, vehicles, harness and saddlery, hardware, stoves, tools, furniture, mess equipment, cordage, construction materials, motor vehicles, marine equipment, repair machinery, laundry machinery, and all animals.

The Ordnance Department procures rifles, pistols, machine guns, artillery and ammunition of all kinds, aircraft bombs, fire-control instruments, target materials, grenades, trench-warfare materials, pyrotechnics, special motor vehicles, tanks, and tractors.

The Signal Corps procures communication equipment of all sorts, wire and cable, radio equipment, batteries, photographic and meteorological equipment, and pigeons.

The Corps of Engineers procures surveying equipment, lithographic and map-making materials, searchlights, bridges, railroad rolling stock, railroad shops, lumber for troops in the fields, and water-supply equipment.

The Air Service procures all airplanes and balloons, the engines therefor, special raw materials which are needed for its aircraft, such as spruce and airplane dope. It also buys special trucks needed for its work, lubricants, aerial signaling apparatus, and special aircraft armament.

The Medical Department procures hospital supplies, surgical, dental, and veterinary instruments, drugs, chemicals, reagents and laboratory supplies, and all hospital equipment and furniture.

The Chemical Warfare Service procures war gases and their containers, chemicals, smokes, incendiary materials, gas masks, and other gas defense equipment.

Each branch has a distinct problem. We have those branches of which the Quartermaster Corps is the chief representative, dealing in vast quantities of supplies, mostly commercial in character. On the other hand, we have the case of the Ordnance and Air Service dealing in items which are either not produced commercially in time of peace or in such limited quantities as to have little effect upon wartime procurement. With the first class (those dealing in commercial products) the problem is merely one of stimulating production for which peace-time facilities already exist. The main thing in this connection is to see that specifications follow as closely as possible commercial standards.

The problems facing the Ordnance Department and Air Service are peculiarly critical. In the case of the Ordnance Department, the maintenance of war reserves is vital. While at the present moment we are fairly well off in this connection, ten years or even five years hence we probably will be in much worse shape, especially in the matter of explosives. Weapons of war change rapidly, and it is very difficult to forecast ten years in advance the types that will be required. It is very unlikely that Congress will ever consent to appropriate in time of peace sufficient money to maintain a war reserve which military men would like to have in order to insure a more rapid mobilization. There seems to be, therefore, but one thing to do in connection with the ordnance problem, and that is to secure sufficient appropriations annually to keep the art of manufacture alive. This will involve placing annually "educational" or "experimental" orders with selected facilities, furnishing them with the necessary jigs, dies, gauges, etc., in order to encourage them to experiment in the manufacture of these non-commercial articles.

The Air Service problem is even more critical. It is wholly dependent upon an infant industry which offers considerable hope for the future, but which at the present time is in bad condition due to lack of interest in commercial aviation. Congress is considering

proposals to encourage civilian aviation, and through some legislative stimulus of flying, as well as the encouragement of mail service by airplanes, it is hoped to encourage aircraft production so that it may furnish some foundation for expansion for wartime requirements.

The chiefs of the supply branches have assigned various officers of the Regular Army to the duty of making continuous studies of the problems of procurement and submitting professional papers on the subject assigned. Several hundred officers are now making these studies in addition to their regular duties. Some reserve officers also have agreed to make similar studies.

The general idea is that for each class of supplies, of which there are about ten in each branch, there will be a small group of Regular officers and a group of Reserve officers who are studying the question from various angles; this will give to each procuring service a number of officers who are well qualified to carry out the responsibilities of the service in procurement matters. In this manner Regular officers will learn something of industry; Reserve officers and others engaged in industry will become familiar with the military features involved; and all, working together, will be able to prepare the necessary detailed plans and keep them up to date to meet any changes in probable war needs or industrial progress. As the planning develops, critical features will become known and deliberate decisions can be made, the advice and judgment of men of great experience in industry being obtained on questions of major importance.

The plans for expansion of personnel, in time of war, must go far beyond the personnel available in the Regular Army. By interesting Reserve officers and patriotic civilians in this work, by keeping them informed of the scope of the plans, and, in the case of Reserve officers, calling them to active duty occasionally, a reserve of industrial staff specialists corresponding to the military reserve will be created. In this way the work of furnishing the expanded Army in an emergency with adequate supplies and munitions will proceed smoothly and without confusion as the work will be directed by men familiar with the war-time problem they are confronting, and bring to it their special knowledge and training from civil life.

Where the plans reach beyond the operations of the War Department in time of war and deal with such activities as were handled in the World War by the War Industries Board, the War Trade Board, the Food Administration, the Fuel Administration, the Railroad Administration, and similar bodies, the functions of the department are confined to making plans and keeping them up

to date, based upon a thorough study of what happened here and abroad during the last war. Prominent men who had experience along these lines are called upon for advice. When war comes these plans will be submitted to the President for consideration.

As above noted, the National Defense Act placed upon the Assistant Secretary of War the responsibility for preparing plans for mobilizing material and industrial organizations essential to war-time needs.

Some of the problems which will confront the Government and which must be solved by industrial experts are—

Capital: Finance manufacturers to whom war contracts have been allocated. Prevent profiteering. Stabilize prices in time of war.

Larbor: Provide machinery for the settlement of industrial disputes in time of war. Insure a proper distribution of labor. Prevent the assumed necessities of industry becoming a haven for "slackers."

Facilities: Equalize the war load so that industries are neither overloaded nor made inactive. Determine what industries are less essential and provide for them in time of war. Plan conservation in industrial methods.

Raw Materials: Provide for a constant flow of raw materials. Provide for the equitable distribution for the best interests of the Nation. Effect of tariff on strategic raw materials.

Power: Prevent overloading of districts to meet increased demands. Utilize power most economically.

Transportation: Maintain railroads and rolling stock in good condition. Obtain maximum efficiency in the use of rolling stock. Make best use of highways and waterways to supplement railroad transportation.

It is hardly necessary to point out what a tremendous saving a sound plan for industrial mobilization will be in time of war. During the World War the Government departments competed with each other and there was much confusion and lack of coordination. Some industries found themselves swamped with orders they were unable to fill, while other industries were ruined by a sudden cessation of their normal business. In a well-devised industrial mobilization scheme much of this can be avoided. This is a matter of vital importance to the taxpayers. The Army will be equipped for war months sooner than it was during the World War. The war will be shortened by just that much, thereby saving thousands of lives and billions of dollars. It will also mean a minimum dislocation of the normal economic effort and facilitate a return to peace conditions.

EDITORIALS

John W. Weeks

SECRETARY of War John W. Weeks has resigned his office because of ill health. Taking up the portfolio of Secretary of War during the administration of the late President Harding, Mr. Weeks has worked hard to bring the Army to a high state of efficiency. He has been unusually successful in the administration of the affairs of the War Department, and the Army came to look upon him as a personal friend. In his farewell statement made just after he attended his last cabinet meeting, Mr. Weeks stated in part:

> My resignation has been tendered to the President. I had hoped to be able to resume my duties, but my physicians advise me that it will be several months before I am able to undertake any strenuous work. Due to the very kind consideration of President Coolidge, I have remained in office in the hope that I could soon return to the Department. I have devoted the past twenty-five years to public service. It is my main interest and naturally I dislike to leave it. I have come to the conclusion, however, that the nation is entitled to a better performance of this important public duty than I am able to give at this time, and therefore I have resigned.
>
> I am especially reluctant to leave the War Department at this time. With a Regular Army of twelve thousand officers and one hundred twenty-five thousand men, a National Guard force of one hundred seventy-five thousand men, a reserve of more than ninety thousand officers, the annual citizens' military training camps of between thirty and forty thousand men and the Reserve Officers' Training Corps, it is not to be expected that there will be unanimous agreement as to the policies of the War Department. There may be room for legitimate criticism, but, on the whole, this great force has worked together as a unit, and during my incumbency I can say that they have worked together most harmoniously. I believe that under the Defense Act of 1920 the Army of the United States has made the greatest advance in its history and has never been more

> efficient or more prepared for immediate and effective expansion to meet the requirements of war. * * * I have every confidence that a fair investigation of the Army will demonstrate its efficiency and preparedness. * * *
>
> The President has appointed as my successor Honorable Dwight F. Davis. Mr. Davis has had two and a half years' experience in the War Department, the first two years in the performance of the duties assigned by law to the Assistant Secretary of War and the past six months as Acting Secretary of War. He has administered the affairs of the department with intelligence and ability. I have every confidence in his judgment and common sense. I am grateful to him for his wise counsel and assistance to me and I know he will enjoy the same loyal support that I have received during the past four and a half years. * * * It is with great personal regret that I leave the War Department. I love the Army. The same patriotic spirit and devotion to country that led it to victory in the World War imbues its officers and enlisted personnel in time of peace. I have an unshakable faith in our Army and a deep gratitude to my associates who have been so largely responsible for its administration during my incumbency as Secretary of War. I leave them with the assurance that I will continue my interest in their problems and will always be ready to assist national defense to the extent of my ability.

The Army regrets that Mr. Weeks feels it necessary to retire from office. Its feeling is best expressed in the words of President Coolidge, who in accepting Mr. Week's resignation, stated: "The country is losing a valuable public administrator, and I am losing intimate contact with a friend. You will go down in history as a great Secretary of War."

The Library, Coast Artillery School

On another page the JOURNAL has initiated a new department under the title "Library, Coast Artillery School." In it will be listed from month to month the books received by the library of the Coast Artillery School. The Library wishes to extend every available facility to officers of the Coast Artillery Corps "from Maine to Manila," and takes this method of advertising its most recently accessioned books.

The *raison d'etre* of the Library is primarily as an adjunct to the Coast Artillery School, but only slightly second to this is its desire to assist all members of the Corps by supplying, suggesting, and recommending personal literature. As it must of necessity serve

the School first, it is not always possible to lend particular books to officers at a distance from Fort Monroe when such books might be needed for immediate use by directors, instructors, or students at the School and when there is a small number of copies of such books. Fortunately, however, among its 42,000 catalogued books, only a comparatively small percentage are under this restriction. It will be worth the while of any officer to write and request books on the subject in which he is interested or on which he wishes to increase his knowledge; or if he so desires he may give the titles of books which he would prefer, and the Library will make every effort to supply such books or others on the same subject. The books are sent under franked mail, with a return franked label enclosed.

The time limit for the return of borrowed books varies with the number of demands which the Library has for that particular book, with the distance of the station to which it is sent, and with the probability of its being needed for School use. Every request for books is separately handled and separately considered, and in each case an attempt is made to give as long a loan as is thought consistent with the needs of other patrons.

In addition to lending books the Library is very glad to give unbiased criticism on books which an officer contemplates purchasing, or to suggest books on any subject. A very complete set of English and American Bibliographies can be consulted, and the facilities of the Bookshop of the Coast Artillery Journal offer exceptional opportunities for the obtaining of any publication in print, usually at a saving from retail price. Through this same source, subscriptions can be entered to magazines of a professional nature and of a general character.

The arrangement of the Library is such that books of a general nature, such as Encyclopedias, Dictionaries, Atlases, and Directories, which are termed "Reference Books," are segregated in a separate room—the Reference Room—and are not available for issue except in unusual cases by special permission from the Librarian. For this reason, such books could not be sent to borrowers, but where their use is indicated in reading up on any subject, it is believed that officers would be able to consult such books in libraries in their own vicinity. Periodicals, as a general rule, come under the same restriction so far as copies for the last few years are concerned. With older issues which have considerable historical value, the Library is fortunate in possessing fairly complete sets, and a desired volume can usually be spared for a brief period.

While the Library is attempting to be of every possible service to the Corps at large, it is hoped that members of the Corps will,

when the opportunity offers, assist the Library by suggesting for purchase any new or unusual books which they have found to be of value and, when convenient, advise the Librarian as to the titles of any books which they may have in their possession and which they may not desire to keep. Such books would, at times, serve to complete sets or to give the Librarian additional resources on subjects which are not completely covered in the present Library files. This especially pertains to old issues of Drill Regulations, Manuals, and articles of historical interest on Artillery or related subjects. Arrangements can be made whereby such books can be sent to the Library without cost to the donor, but the Librarian should be consulted in each case before shipment is made.

A very complete Map Room is being arranged and through the courtesy of the Map Division of the War College, the Library is in possession of a fairly complete sets of French and British maps covering the European War. These maps will be available for loan, but as it will be practically impossible to replace any of them, the borrower will be requested to exercise extreme care in handling them. So far as the United States and its foreign possessions are concerned, the Library can suggest maps, on several different scales, covering practically any desired section, which can be obtained at very low cost from Government Departments.

To sum it up, when you want information in any of the lines listed above, "Ask the Librarian."

The Case of Colonel Mitchell

[Reprinted from the New York *World*]

It is clear that given his temperament Col. Mitchell ought either to be out of the Army or at the head of it. He is an impossible subordinate. No army anywhere could maintain its self-respect if it permitted its officers to abuse each other in public as Col. Mitchell has abused his superiors. If Col. Mitchell wishes to reform the administration of the Air Service, it was his duty first to make his suggestions through the regular channels and then if they were ignored to resign his commission and conduct his agitation as a civilian. It does not matter how right he may be, as a military man he cannot be permitted to conduct a public propaganda and a Congressional lobby of his own.

Some who have commented upon the affair have assumed that to deny Col. Mitchell the right to issue his statements was a denial of free speech and an infraction of liberty. That is not the case. There is no more fundamental rule of civil liberty than that which

forbids the military to engage in political agitation of any kind. If Col. Mitchell had attacked the pacifists as he has attacked the Army administration, the pacifists who are now defending him in the name of free speech would be trouncing him as a militarist. If Col. Mitchell had attacked the big-navy people or the conscriptionists, Mr. Hearst, who has rushed to his support, would have attacked him for not minding his own business. The only rule, therefore, is to insist that all officers attend to their duties and abstain from publicity, and if they have anything sufficiently important to say that they resign and say it as civilians.

The truth or falsity of Col. Mitchell's charges has nothing whatever to do with his right as an officer to conduct a propaganda. Every man who conducts a propaganda is no doubt as sincerely convinced he is right as is Col. Mitchell. But unless the War Department is to display gross favoritism or abject fear of Col. Mitchell's political strength it cannot allow him liberties which it would not allow any other officer who felt he had something he wanted to say. The truth of the Mitchell charges is a matter for Congress and the President to determine; the immediate business of the War Department is to make a civilian out of Col. Mitchell. Then if the charges of Mr. Mitchell are sustained by a civilian body Mr. Mitchell can, if necessary, be made Secretary of War and allowed to reorganize the whole service.

But from a subordinate officer of the United States Army, were he prophet, sage and genius, infallible and inspired, such conduct as his is destructive and intolerable. It promotes that curse of armies, factionalism and intrigue. It destroys discipline, and discipline in an army, far from being parade-ground stuff, is the very thing which in battle and in crisis makes heroes out of ordinary men and enables cool heads to rule excited hearts. Armies are not democratic assemblages. They are autocratic organizations with a ritual and a point of view distinct from that of civilian democracies. There is no use trying to mix the military and the civilian attitudes. The safety and the effectiveness of each lie in keeping them rigorously distinct. Once you try to mix them you enfeeble the army by encouraging an individualism that it cannot digest, and you produce militarism in its worst form by putting the army into politics.

Discipline is not a fad of the Army's. Discipline is what makes it an army. Uniforms don't make an army. Guns don't make an army. Personal courage does not make an army. Without discipline there is only a mob. Without training which enables great masses of men to be directed by a central command transmitted through a hierarchy of officers there is no army. No wonder soldiers take dis-

cipline so seriously that to a civilian they often seem obsurd. They are so thoroughly impressed with the helplessness of undisciplined men in an emergency that they put an emphasis on discipline which civilians find it hard to understand.

It is the public's business to understand it in the case of Col. Mitchell and to realize how conduct like his strikes at the roots of solidarity in an army. When he is once more a civilian like the rest of us he should be listened to with respectful attention and his charges pursued to the end. But while he remains an officer there is no course open but to subject him to the same standards of conduct which every other soldier must obey.

The R. O. T. C.'s Make Good

[Reprinted from the Chicago *Tribune*]

Col. Girard Sturtevant, commanding at Camp Robinson, Sparta, Wis., where artillery reserve officers are being trained, says this country for the first time has a military policy that is both practical and economical.

The fundamental of preparedness, he believes, is the training of reserve officer. This country lacked a corps of reservists when our last war began and the consequence was that our army was officered to a considerable extent by men who were crammed with military knowledge in three months of intensive training. The training had to be incomplete. Men were given commissions, as most of them will admit, long before they were competent to command men in action. The country needed officers above anything else and those who showed aptitude had to take commands before they were ready for them. Many lives were sacrificed needlessly because the officers didn't know their jobs.

We should be in a somewhat stronger position if a war were to be declared in the next few years. There are 80,000 civilian officers who saw action in the war and have since been enrolled as reservists, but it is now seven years since the armistice and in another five or ten many if not most of the civilian officers with combat experience will no longer be eligible for active duty.

The country will then have to rely for its reservists almost entirely upon the younger men who received their military training in the colleges and universities. In most of the land-grant universities, military training is compulsory. It is so at the University of Illinois, where twenty-six regular army men are stationed to instruct the students. Many other universities, such as Yale, have splendid volunteer corps. Men who have had military training in the colleges,

and especially those who have had, in addition, instruction in the technical schools, will become the nation's main reliance.

The college training must be supplemented each year by a few weeks of instruction, such as that at Camp Robinson. The system is not ideal, because it neglects to provide trained men in the ranks, but it is the best we are ever likely to get in this country. As Col. Sturtevant has said, it is practical and economical.

Obviously, the bulk of the training of future reservists must be given on the campus. No effort should be spared, therefore, to impress undergraduates with the importance of that training for the safety of the republic. Similarly, no effort should be spared to impress Congress with the importance of the training of reservists. Great pressure will be put upon Congress this year to slash the military appropriations. Unless the significance of the reserve is constantly emphasized, inadequate provision will be made for it. Nothing could be more disastrous to the nation's defenses.

When Winter Comes

The cold, gray days of winter are upon us. The trees stand forth naked to the sky. The fields are bare, and the corn stalks rustle crisply in the winter breeze which coldly passes by. The deserted road echoes hollowly under the footsteps of the occasional pedestrian hastening to the comfort of his fireside, and the fallen leaves, gold and brown and purple, scamper from underfoot as they, too, seek a shelter of their own. Without, all is dark and gloomy; within, all is cheerful and bright. Winter is here!

The training camps have been broken up and the tentage stored away. The drills of the summer are all past and gone. Programs of training have been filed as completed; new programs begin to appear. Troops are again in their barracks; officers once more are at home. The outdoor season has gone its way, and the indoor season begins. Summer is past! What of winter?

As the flames roar in the fireplace through the long, cold evenings of winter, how shall we pass the time? While the wind drearily moans down the chimney and the snow pads softly against the window panes, what shall we do? Shall we waste time in amusements, in cards or games or play? Or shall we, perchance, catch up on our professional reading—lose ourselves in the adventure and romance of military history or follow in spirit the lives of great soldiers of the past, engross ourselves in the study of tactics and tactical development or improve our knowledge of technic? Summer is gone! What of winter?

The American Soldier

[Reprinted from *Liberty*]

What has the uniform of the American Army meant in the life of the American people? In the first place, after colonial days and its wars, it meant the Revolution and the making of the nation. Then the War of 1812, badly fought because the Army was neglected. The clearing out of the Indians, necessary if this nation should exist * * *.

It meant the settlement of the Mississippi Valley and of the southern Appalations, the acquirement of Florida, of Texas, California, and the coast up to British Columbia.

This was the work of the American Army. Without it the Indians would be all over the place or Europeans would be here. Certainly Mexicans or Japanese would be on the Pacific coast and in its valleys.

The Northern Army kept the Union together after a long war made necessary by the gallantry of the Southern Army.

Which of these results were bad? If not bad, what is there contemptible in the uniform of the American Army?

The Chinese have been overrun by aliens not because they liked peace but because they not only disliked but degraded soldiers. A nation should like peace, but it cannot safely put the soldier under an odium. It may avoid being the Germany of the soldiers who held civilians in contempt and made them get off the sidewalk, but it also must avoid China, which cleared the sidewalks of the soldiers.

When in any considerable number of American States the uniform of the American soldier is in bad form the American nation is out of luck.

It is my firm conviction that the duty of national defense, like the general duty of citizenship, should be broadly extended and borne by all our people.—*President Coolidge.*

PROFESSIONAL NOTES

Seacoast Artillery Firing

[COAST ARTILLERY BOARD PROJECT NO. 220]

EDITOR'S NOTE: *Coast Artilery Board Project No. 220 is one of the most important and most interesting projects ever undertaken by the Board. The* JOURNAL *regrets that the length of the project is such that it can not be given in full in these pages. However, the project with omissions reduced to a minimum, has been secured from the Coast Artillery Board for publication in three parts, of which this is the second. The action of the Chief of Coast Artillery on all parts of the project published herein will appear with the final installment.*

13. *Position Finding. a.* There are three methods of position finding now in use in the Coast Artillery, to wit: (1) horizontal base; (2) vertical base; and (3) the Coincidence Range Finder.

b. Horizontal base lines are in general use throughout the service because long base lines with corresponding great accuracy can be had in almost every locality. Another reason for their general use is that it is not necessary to have such good definition of the target in the instruments for accurate range finding with the horizontal base as with either a depression position finder or the coincidence or stereoscopic range finder, nor is it necessary to see particular parts of the target. The long horizontal base gives the most accurate results in night work for all ranges, and particularly is this so at dusk and dawn. At these times the inherent difficulty of putting all concerned on the same target is increased. The difficulties under which the horizontal base instruments work at night are greatly increased by interference from searchlights. The principal objections to the horizontal base may be said to be:

(1) Difficulty in getting both base-end instruments on the same target.

(2) Distance of stations from unit commander.

(3) Inherent weakness due to communications, number of stations, instruments, etc., the breaking down of or material interference with any one of which puts out a particular base line.

(4) Limitations on the location of searchlights.

(5) Difficulty of defending stations.

Of the above objections, the effect of (3), which heretofore has been the most serious, is reduced by taking advantage of the flexibility afforded by the Cloke Plotting and Relocating Board in conjunction with a flexible communications system and providing for multiple base-end stations. The seriousness of the other objections is decreased by providing either vertical base instruments or other self-contained range finders for emergency use. Assuming multiple base-end stations supplemented by emergency position finding equipment, it is believed that the serious crippling of the position finding elements of seacoast artillery

will require an expenditure of ammunition which attacking fleets could rarely afford. Certainly we are in a more secure position in respect to position finding than we have been in the past.

c. The vertical base is applicable only where there are natural high sites. This makes it a special case. With the improvements now being realized in depression position finders, there will be certain situations where such instruments will give satisfactory results under favorable circumstances up to 20,000 yards. Even where there is sufficient height of site, accurate position finding with D. P. F.'s depends upon the ability of an observer to waterline the target and upon there being a clear atmosphere in the daytime or excellent illumination at night. The vertical base system may be said to have on and off days or to be as uncertain as to weather. These defects are compensated to some extent, when compared to the horizontal base, by the less number of stations, observers, instruments, and lines of communication, which make for relative simplicity. In some cases the vertical base may be at or near the battery, so that communication lines will be very short, or so that communication, in emergency, may be by megaphone.

d. Coincidence and stereoscopic range finding offer much the same advantages as vertical base, but are of little value for night work, though for day work the methods are sufficiently accurate for good plotting at comparatively short ranges. They should be regarded solely as emergency methods, of sufficient value to justify their cost.

e. For night work the range finding system is normally dependent on the illumination of the target, except when the enemy's searchlights are directed toward the batteries for a sufficient length of time for range finding with a coincidence range finder. Upon the results obtained in night work and under unfavorable conditions of visibility due to haze and fog should depend the method of range finding which should be adopted as standard. History affords few instances of successful naval atack at night against fortified harbors, but no one has had the hardihood to state a policy of depending on mines alone for our protection at night. On the contrary, it is the determined effort of every one to have range finding conditions such that reliable data for night firing may be obtained as soon as the illumination of the target is sufficient so that it can be seen through a telescope. These being the facts, we almost have to eliminate the coincidence or sterescopic range finder from consideration for position finding at night. Such instruments require so much illumination that satisfactory range finding at night cannot be consistently done beyond 4000 yards. Similarly for D. P. F.'s or vertical base instruments there will be little or no "bone" at the target to waterline, but the limitations of the vertical base for night work are not so great as those of the coincidence range finder. Comparative results depend largely on conditions under which the instruments are used. In maneuvers it has sometimes been the policy of the Navy to turn searchlights on base-end stations with a view to blinding observers. Under such conditions vertical bases can do little or nothing but coincidence instruments are at their best.

f. In Coast Artillery Board Project No. 5, ***Test of 30-foot Bausch and Lomb Range Finders,*** the Coast Artillery Board stated as follows:

> The Board is unable to come to any definite conclusions at this time as to the relative merits of the 30-foot range finder and the D. P. F. at varying heights of site, observing on a target at varying ranges. While it is believed that it is as easy to train an observer to effect coincidence

> as to train him to waterline a target, the amount of training required for an observer on either instrument probably will not be the determining factor in the selection of an instrument. Where the height of site obtainable for a D. P. F. is sufficient to give it an accuracy comparable with that obtained from the 30-foot range finder, considerations of economy will dictate installation of the D. P. F.

The recommendations of the Coast Artillery Board on its Project No. 5 were as follows:

> 20. In view of the excellence of the results obtained in this and in previous tests it is recommended that the policy be adopted of equipping eventually each battery of Coast Artillery, fixed or mobile, with a suitable range finder for emergency use.
>
> 21. It is recommended that a coincidence range finder equal to or superior to the 30-foot instrument tested be assigned to each battery of 12-inch long range guns, 14-inch guns, 16-inch guns, and 16-inch howitzers.
>
> 22. It is further recommended that a range finder equal to or superior to the 4-meter instruments tested be assigned to each major-caliber fixed battery other than those enumerated in Par. 21.
>
> 23. The assignment of a portable range finder equal to or superior to the 4-meter instruments is recommended as suitable for emergency use by mobile batteries, both tractor drawn and railway. * * *

In Coast Artillery Board Project No. 74, *Fire Control System for 155 G. P. F.'s*, recommendations were made for a self-contained range finder for each battery for emergency use. These recommendations were approved by the Chief of Coast Artillery.

g. From the above discussion it will be seen that the system which is the more desirable from one point of view fails under certain conditions, and this makes it necessary to supplement the adopted standard with another system which is termed emergency. Admitting that the horizontal base system is not perfect, it is, to date, the most satisfactory position finding system developed and merits being the standard. It is the understanding of the Coast Artillery Board that for all batteries, fixed and mobile, the horizontal base system is the adopted standard, and that in connection with this system, where the height of site justifies it, the base-end instruments will be D. P. F.'s, thereby providing a vertical base emergency system. Where a D. P. F. is not provided at a battery it is believed that ultimately either coincident or stereoscopic range finders should be supplied for emergency use for both fixed and mobile seacoast batteries.

h. Seacoast cannon should be emplaced so as to obtain a maximum field of fire in the seaward area. It is desirable to emplace seacoast artillery so that as nearly as possible the entire gun range may be used over the water area to be defended. Conditions will sometimes dictate that batteries be retired somewhat from the shore line in order that they may be given a position in which they may have protection and concealment from seaward attack as well as better siting. The position finding system should be such as to furnish accurate data for firing seacoast cannon to their maximum range, since a particular situation, such as covering the debouchment of a fleet, may demand fire at extreme ranges. For the present, such extreme ranges will not exceed 49,000 yards. If in a particular locality, terrestrial visual position finding cannot be used to give data up to maximum gun ranges, the system must be supplemented by some other position finding method. The daytime effectiveness of terrestrial visual position finding from properly located stations will depend upon atmospheric conditions, that is, con-

ditions of visibility. These conditions will be more favorable in some localities than in others, and will vary from time to time in the same locality. Considering the position finding stations as an origin, terrestrial visual observation is in some localities effective up to distances of 35,000 yards; in other localities the maximum will not exceed 20,000 yards. During foggy and hazy weather the distances will be very much less. At night, with means now available for target illumination, the maximum distances from the station for which under the best conditions we may expect satisfactory results is 12,000 yards. It is therefore evident that with stations located approximately on line with the battery, terrestrial visual position finding would not furnish data for fire at the maximum gun-target ranges of some armament. If, however, the stations are advanced from the battery along the field of fire, just so much as they are advanced will they increase the possible gun-target range which the battery can cover utilizing accurate terrestrial visual position finding data. In localities where the terrain permits, observing stations should be advanced sufficiently to give position finding data throughout the limits of the possible range of a battery. The amount of advancement will depend upon the range of the gun, the distance of effective visibility, and the available positions for stations which will cover the field of fire and at the same time give favorable angles of intersection. In some cases the stations need be advanced but little to provide for the maximum range of the guns, but it should be noted that in such cases any advancement given will increase the gun-target ranges for which position finding data may be furnished under unfavorable weather conditions and at night. In other cases, and perhaps the usual ones, the stations should be advanced as much as 20,000 yards. In general, such advanced stations can be represented on the Cloke Plotting Board and the plotting carried on in the usual way. In some particular situations some of the stations may have to be advanced so that at times the target will be between the battery and the position finding stations. In these cases, the plotting could not be carried on the Cloke Board in the usual way. The Coast Artillery Board is investigating a means for meeting situations similar to the above. At this time, it appears that one solution for situations similar to this would be obtained by the use of two Cloke Plotting and Relocating Boards. A plotting section could be organized at the stations and equipped with one Cloke Board. On this board the target would be plotted with reference to a convenient directing point, and then relocated with respect to the battery on a Cloke Board in the battery plotting room. A situation for which a solution similar to the above would apply probably exists in connection with the Defenses in Long Island Sound. At one entrance of the Panama Canal conditions are such that terrestrial position finding in connection with advanced stations may furnish data for the maximum range of the armament. At the other entrance of the Canal advanced stations are not practicable, so that terrestrial visual position finding is satisfactory only to the extreme limit of visibility from the stations restricted to locations approximately on line with the batteries. In this situation and in other similar ones, the terrestrial visual position finding system should be supplemented by some other system. Specifically, what such system will be remains for future determination, and its development is having the consideration of the Coast Artillery Board. One method which is worthy of consideration and which offers a good basis for development is that of "Position Finding by Airplane," described in the COAST ARTILLERY JOURNAL for January, 1923. Essentially, this method is one of ballistic range firing or using the gun as a range finder in connection with the speed and course of the target, reported to

the battery by aircraft. In this connection, it appears that except in special situations, subaqueous sound ranging may have to be eliminated because of expense, and that the outlook for satisfactory position finding from balloons is not very encouraging.

* * * * *

j. Two observing stations per battery are not sufficient even with facilities for interchange of base lines between various units. Permanent multiple stations should be provided and such provision is understood to be the policy in new installations. It is entirely practicable to construct for each battery a number of emergency observing stations with little expense, except for azimuth instruments and means for communications direct to the battery, so that under no probable conditions need a battery be without a pair of stations for range finding.

* * * * *

14. *Concentration of Fire and Number of Cannon in a Battery.* *a.* Each battery being furnished with position finding stations, provision is thereby made for assignment of batteries to different targets or to the same target. Concentration of fire by batteries on one or more targets occasionally will be desirable, particularly at extreme ranges. At moderate ranges, and at ranges within which, in the great majority of our harbors, hostile vessels must approach and remain for a considerable period in order to accomplish any mission seriously damaging to the defense, the Coast Artillery Board believes that a single high-powered gun, efficiently served, frequently will be a suitable assignment to a single enemy target. In certain of our fortifications, a battery consists of a single high-powered gun. Recently the tendency appears to be toward several high-powered guns in a battery. * * *

b. The following is quoted from "Concentration of Fire," pages 14 and 15, *Tactical Employment of Heavy Artillery.*

> Fire should not be concentrated on one element of the enemy's forces, however, if such concentration would leave another element free to accomplish an important mission. * * *
>
> In case of a direct naval attack * * *, this may necessitate concentrating fire or dividing it. * * *
>
> It is then a matter of no great difficulty to work out a plan in time of peace for the assignment of targets in the various circumstances that may arise in time of war.

If it can be shown that under any probable conditions of action between naval forces and the defenses of a particular locality, distribution of fire might be desirable, then provision of a fire control installation which contemplates only the concentration of practically all the armament on a single target is unjustifiable. The additional cost of a more flexible system is insignificant compared with the total investment in defensive installation.

* * * * *

g. (1) The reason for railway seacoast artillery is that it possesses strategical and, with obvious limitations, tactical mobility. The number of such guns at the outbreak of war will be limited. The tactical situation in a particular locality may dictate emplacement of high-powered railway guns in such widely separated positions that they will fire as separate units and require separate position finding and fire control systems. Conditions may even dictate assigning these high-powered guns singly to widely separated localities. It appears that the need for a separate fire control and position finding

system with each 14-inch or larger caliber railway cannon is greater than with fixed cannon of similar power. * * *

(2) A single position finding and fire control system cannot be operated so as to furnish moving target firing data for more than two directing points without sacrifice of accuracy, or rapidity of fire, or both. A tractor battery of four seacoast guns can normally be emplaced on any terrain with the separation necessary for protection and still with such grouping as to permit the use of not more than two directing points. The emplacement of a 4-gun railway battery for moving target firing is a much more difficult problem. Limitations of terrain and trackage will normally enforce emplacement in such widely separated positions as to require more than two directing points. It follows that a separate position finding and fire control system is required for each two railway guns in coast defense. It is therefore believed that in no case should railway artillery be organized for coast defense operations with less than one position finding and fire control system for each two guns. Tactical considerations will not demand the organization of railway guns and mortars of less than 14-inch caliber into one-gun batteries. For these reasons it is believed that railway artillery under 14-inch caliber should be organized for coast defense operations into two-gun batteries. If, for calibers under 14-inch, two-gun railway batteries cannot be adopted, then a complete position finding and fire control system for each two guns should be provided, and tables of organization and T. R. 435-225, *Battery of Railway Artillery*, amended accordingly.

(3) In considering the foregoing, the Coast Artillery Board believes that the gain in tactical effectiveness of these high-powered weapons will more than justify the expense of providing the additional materiel and personnel.

15. *Prediction. a.* Since 1912, predictions have generally been made on the plotting board. It is not believed that any mechanical means can be devised which will furnish predictions equal in accuracy to those obtained from the graph of the target's course. Where changes in the course of the target are encountered, poor predictions will follow for a while, but good observation from observing stations, accompanied by prompt report to the plotting room of changes of the target's course, will reduce their number. The accuracy of prediction necessarily depends in a large measure on the plotter. He should be a man of good judgment, have natural aptitude for his work, and above all he must be trained painstakingly. Battery commanders are prone to let plotters drift into the habit of using setforward appliances in predicting the direction of the target as distinguished from using the appliances in determining the distance the target travels during the predicting interval (the observing interval or a multiple thereof) plus the time of flight. Until a sufficient graph of the target's course is obtained to permit the plotter to use his judgment as to prediction of direction, it is true that prediction of direction on a straight line through plotted points is probably the best procedure unless observers report the target as changing course. When the graph of the course begins to take definite shape and observers are reporting changes of course, the plotter should be trained to make freehand predictions of direction a short distance in advance; then on the predicted direction he should measure off, using the setforward device, the proper distance to be passed over during the predicting interval plus the time of flight. Accurate prediction of direction is largely a matter of training. The necessity for this training was emphasized in

Artillery Bulletin No. 108 (Serial No. 123), dated December 8, 1914. This bulletin has never been rescinded and should not be forgotten. The more simple a predicting device is, the more the plotter's mind will be freed and the more time he will have to concentrate on the prediction of direction and the visualization and plotting of the future probable course of the target. Where errors of sufficient magnitude between the setforward points and the plotted track become evident these errors should be taken into consideration when applying corrections as a result of observation of fire (See Par. 38 *i*).

b. Prediction Devices in Coast Artillery Board Project No. 93. In this study the Board considered the following methods and devices for locating the setforward point:

(1) The Fenton Predictor, JOURNAL OF THE U. S. ARTILLERY, Nov.-Dec., 1915.

(2) The Jones Setforward Ruler, JOURNAL OF THE U. S. ARTILLERY, Jan.-Feb., 1917.

(3) The Frost Circular Logarithmic Predictor, JOURNAL OF THE U. S. ARTILLERY, March-April, 1917.

(4) The Frank Predictor, the Moody-Cummings Predictor, the Willet Coast Artillery Board Predictor, the Frost Predictor, the Proportional Dividers Predictor, all of which were described in the JOURNAL OF THE U. S. ARTILLERY, January-April, 1918.

(5) The Proportional Pantograph Predictor, which is in use in the service.

(6) The Setforward Ruler, which is issued to the service.

(7) The Wells Mechanical Predictor.

(8) Free-hand Prediction, as occasionally used in the Coast Artillery.

(9) Time-Range and Time-Azimuth Prediction Board methods for obtaining the position of the setforward point.

c. All of the above methods and devices were concerned with predictions in conjunction with manual plotting boards. After thorough investigation the Coast Artillery Board concluded that:

> 3. Considering the location of setforward points for a target traveling at high speed (500 to 1200 yards per minute) on courses which are irregular both as to speed and direction, in conjunction with the wide variation (0 to 84 seconds) in time of flight of Coast Artillery projectiles, it is concluded that none of these devices is very satisfactory or possess any material advantages over any one of the others.
>
> 4. That free-hand prediction, in which the proportional pantograph or proportional dividers are used as a guide, is the least unsatisfactory, and that prediction on Time-Range and Time-Azimuth Boards will compare favorably with this method.

d. In *service*, battery commanders generally improvise setforward devices; consequently there are a great many different kinds of devices in service. Most of them require that the travel during the observing interval, the time of flight, and distance to the setforward points be called out, and that an additional man be provided to help the plotter. Such devices as are operated by the plotter alone take so much of his time and put such a burden upon him that he has neither the time nor the freedom of mind to concentrate on predicting in direction.

It is desirable to reduce to a minimum the calling out of data in the plotting room and also to operate with a minimum of men.

e. The pantograph predictor is operated entirely by the plotter, who obtains the time of flight from a tabulation which he can see, or has the time of flight called to him. Unfortunately, some plotters find difficulty in handling the pantograph due to their unfamiliarity with instruments of its kind.

f. A very simple setforward device is described on page 43, part II, *Gunnery for Heavy Artillery.* It is excellent for high-velocity guns using a single charge and projectile, and gives the setforward point without supplementary means. It requires a scale for each two hundred yards range. The objection is the number of scales required to care for all ranges. However, the scales may be placed where the plotter can readily reach them; or six, or even twelve, such scales may be placed on a short piece of wood of triangular cross-section. A similar result may be obtained by placing several scales on a sheet of paper which can be folded so that any particular scale may be used. Such sheets of scales have been printed and may be obtained from the Coast Artillery Board.

g. Most cannon have more than one powder charge and more than one projectile, so that the times of flight for a particular range vary. In some cases it is desirable to predict thirty seconds ahead; in others a minute ahead; and in the case of extremely long-range firing using aerial position finding, it may be necessary to predict as much as two or three minutes ahead. In view of these conditions, it appears next to impossible to secure a prediction device which will be both simple and universal. The Coast Artillery Board is continuing to investigate the question of prediction devices in the hope of securing a standard device which will be an improvement over those at present in service.

h. Training Regulations 435-221, *Fire Control and Position Finding,* prescribes that a predicted point be determined. This use of a predicted point imposes additional labor upon the plotting details and others concerned with the application of predicted point data. The reason for imposing the additional labor is that the location of the predicted point is necessary to the method of checking now in use. In Coast Artillery Board Project No. 117, *Fire Control Methods for Mortars,* the Coast Artillery Board advanced the opinion that it is desirable to discontinue the determination and use of predicted point data, subject to requiring a suitable check-back system. This procedure would simplify the operations of the fire control system in Case III firing. It should be noted that for a safety precaution at target practice the azimuth of the setforward point could be utilized satisfactorily by safety officers.

j. T. R. 435-221, *Fire Control and Position Finding,* Par. 14 *a* (3) contemplates predictions based upon travel during two observing intervals. In Case II firing, using normal position finding methods, even fairly well trained troops can predict every thirty seconds and the prediction should be based upon travel during thirty seconds. In Case III firing, using normal position finding methods, fairly well trained troops can predict every thirty seconds using a predicting interval of one minute. In long-range firing, using position finding by aircraft, it may be desirable to predict as much as two or three minutes ahead based upon travel during either a less or similar period. In view of these conditions it is not believed desirable to prescribe either a definite predicting interval or frequency of predictions. The prediction interval should be as small and the frequency of predictions as great as the flow of position finding data and the state of training will permit.

16. *Meteorological Data.* *a.* Considerable improvement has been made since the World War in measuring wind aloft. From the results of experiments made at Aberdeen Proving Ground the following conclusions are justified:

(1) The method which is now in use for making range and deflection corrections, due to wind, has a theoretically correct foundation.

(2) Errors in the application of the wind correction at the battery are due for the most part to unavoidable approximations in order to meet the conditions required in practice by artillery in service, and are not caused by faulty ballistic theory, except as affected by error in the fundamental retardation law. The approximations include:

(a) The effect of periodic instead of continuous receipt of the meteorological message;

(b) The application of wind velocity values determined at one place to firings made at another place; and

(c) The use of approximate weighting factors.

These errors of approximation are probably no greater than the errors involved in applying a velocity or density correction.

b. For trajectories whose maximum ordinates do not exceed the heights to which balloons may be tracked, the values for ballistic wind are acceptably accurate. With present facilities and under general conditions of visibility, the pilot balloon is lost from view at from 2,500 to 3,000 yards, though under favorable conditions it is observed to considerably greater heights. The values of the direction and velocity of the wind are satisfactorily determined for direct-fire guns. For trajectories whose maximum ordinates exceed those for which accurate wind values can be determined, it is desirable to arrive at an acceptable approximation for the wind values to be used. The present status is indicated by the following statement of the Chief Signal Officer of the Army [O. C. C. A. 665.6/M and OCSO 353.4 (8-25-24)]:

> 1. Data has been and is being furnished by the Signal Corps at Aberdeen Proving Ground for ordinates from 30,000 to 35,000 feet, but this has largely been done by extrapolation when the balloons did not rise to the desired elevations. * * *
>
> 3. This entire matter will be studied with the view of writing instructions which will adequately cover the entire subject of furnishing ballistic wind data for ordinates up to 60,000 feet which must be done by methods of extrapolation and by using averages, or both.

Questions concerning wind aloft are being investigated by the Weather Bureau, the Bureau of Standards, the Ordnance Department, and the Signal Corps. Just what improvement may be expected is problematical, but the outlook, in connection with the meteorological service now available, is sufficiently promising to justify the application of wind corrections, especially for deflection, even in the case of high angle fire.

c. At the present time, ballistic densities are approximated from the density determined at the ground. The value of the approximations is questionable, but the subject is still under investigation and improvement in the accuracy of the approximations is to be expected. It is necessary to make corrections for the effect on the range of a projectile of changes in air density. This is done most accurately by measuring the density at several different altitudes of the trajectory over which the projectile passes, and from these measured values computing a single "weighted" or "ballistic" density. The measurement of the density is best accomplished by an observer in an airplane which makes a flight up to the

greatest altitude which the plane can reach, but not higher than that of the maximum ordinate of all the trajectories over which projectiles are to be fired. The last two figures of the code group in the Artillery meteorological message give the ballistic density for the various maximum ordinates. On account of the lack of airplane facilities in peace time for making density measurements, it is usually impossible to make the measurements aloft at all forts. In order to use a value of the ballistic density more accurate than the surface density, an approximate method of computing ballistic density for all altitudes, based on the surface density, has been devised and is described on pages 47-8 and 86-90 of *Meteorology for Coast Artillery*, by 1st Lieut. J. J. Johnson, C.A.C. The value of this approximate method of computing ballistic density is questionable. When airplane flights are made the ballistic density can usually be determined quite accurately. At present, the meteorological mesage provides for giving the ballistic wind to the nearest mile per hour, and the ballistic density to the nearest whole percent. It is possible that improvement in the accuracy of making ballistic correction would result from giving the ballistic density to tenths of a percent whenever airplane measurements are made. To show the relative importance of one mile per hour in wind and one percent in air density, the following tabulation is given:

Caliber	Wt. of Proj.	Velocity	Range	Change in Range for Change of	
				1 percent in air density, yds.	*1 mile pr. hr. in range wind, yds.*
	lbs.	*f. s.*	*yds.*		
155-mm. gun	95	2410	5,000	18	1.8
			17,400	91	22.1
12-inch gun	975	2275	5,000	5	1.5
			30,000	118	18.0
14-inch gun	1400	2400	5,000	4	0.3
			23,000	208	23.5

If the accuracy of airplane measurement of air density warrants the use of tenths of a percent in the ballistic density, it is probable that it would be advisable to have the tenths placed in the meteorological message. The advisability of providing for issuing the ballistic density in tenths of a percent in the meteorological message is being investigated.

d. While methods for determining the ballistic temperature are available, the experimental basis for computing the correction is of such questionable value that it is considered advisable for the present to use the surface temperature.

e. The importance of having accurate meteorological data available to a battery is emphasized by a study of the tabulation given in paragraph 18 *a*, following. Meteorological stations are now established throughout the service, but whether they are as yet very efficient at all stations is a question. There is reason to believe that lack of personnel and the difficulties attendant upon organizing a new service have made for unsatisfactory functioning. It is believed this question merits investigation with a view to securing improvement.

* * * * *

17. *Range Board, Model 1905, and Range Correction Board, Model E, 1923.* *a.* Reference is made to Coast Artillery Board Projects Nos. 152 and 170. Due to the increased range of some seacoast armament, the acceptance of the zoning system for long-range guns, and the fact that many gun batteries are assigned more than one projectile, the Range Board, Model 1905, is not suitable in many cases. Investigation was made with a view to securing a satisfactory range board at a minimum of cost. This resulted in the adoption of the Range Correction

Board, Model 1923, for the use of all cannon for which the Range Board, Model 1905, cannot be made suitable. The Range Correction Board, Model 1923, is fully described in T. R. 435-221, *Fire Control and Position Finding*. Range Boards, Model 1905, may be converted into Range Correction Boards, Model 1923, by the addition of an upper and lower roller carrying the correction chart, which is of sufficient length to care for the entire trajectory in all zones of the longest-range cannon.

b. In the past, range boards were designed for use as follows:

(1) To obtain corrected ranges, in which the actual range to each set-forward point was corrected on the board.

(2) To obtain a range correction in yards, which was determined periodically and applied to the actual range of the setforward point. Neither of the above methods was considered satisfactory. The first resulted in a hurried operation of the range board with the introduction of inaccuracies and numerous personnel errors. The second was unsound because it resulted in the application of a flat correction whereas the correction changes when the range changes. Investigations made by the Coast Artillery Board in connection with Project No. 114, *Preparation and Adjustment of Fire at Naval Targets*, indicate that for changes in range of a thousand to two thousand yards, the ballistic correction may be assumed without material error to vary directly as the range varies. With the Range Correction Board, Model 1923, and the Range Board, Model 1905, as it is being modified, a ballistic correction is obtained by careful and deliberate operation without reference to the time interval indicators. This minimizes errors in operation.

c. Curves of ballistic effects may be plotted on the range board charts as percentages of the ranges to a scale of $1'' = 2\%$, and a scale for reading the ballistic correction in percent is being provided for all range boards. The same scale is suitable for reading the ballistic correction in yards where curves of ballistic effects are plotted to a scale of 200 yards equal 1 inch. Pending the furnishing of scales of arsenal manufacture, the Coast Artillery Board can furnish suitable paper scales. The ballistic correction, when determined in percentage of the range, is applied to the actual range of setforward points through a Percentage Corrector (see paragraph 19, following) so as to vary directly as the range varies. In this system new ballistic corrections may be applied to the actual range at any time and as frequently as deliberate operation of the range board permith, but no material error will result if new ballistic corrections are applied at intervals corresponding to a range change of as much as two thousand yards.

d. In Coast Artillery Board Project No. 260, *Percentage Range Correction Charts*, recommendations were made as to the construction of range board charts. It is intended that charts constructed in the future have the following specifications:

(1) Corrections to be placed on chart in following order, counting from left to right:

(a) Velocity,
(b) Atmosphere,
(c) Tide,
(d) Wind,
(e) Projectile weight,
(f) Temperature elasticity of air,
(g) Rotation of earth.

(2) Reference numbers for atmosphere to vary from 84 to 116.

(3) Rotation of earth to be given for 35° N. latitude.

(4) Along right hand edge of chart, range table data for each range to be placed in following order, counting from left to right:

(a) Perforation of armor,
(b) Time of flight,
(c) Probable error,
(d) Angle of fall.

(5) If chart is made for non-armor-piercing projectile, column (4) *(a)* to be omitted.

(6) Where quantities of (1) *(e)*, *(f)* and *(g)* and (4) *(a)* and *(c)* are not available because new type firing tables have not yet been constructed, space on the chart to be left for them and values put in at a later time.

(7) Title to be placed at bottom of chart.

(8) Minimum range to be 3000 yards.

(9) If any of corrections (1) *(e)*, *(f)* and *(g)* are negligible, they are to be omitted placing a note to that effect at bottom of chart.

(10) Check points to be given in % up or % down.

e. When guns having range drums graduated in yards for a standard projectile and velocity are furnished projectiles other than standard, a range-range relation is used (see paragraph 19) *but there must be a set of curves for the range board for each projectile or velocity.* If the sets of curves are on different charts, the charts on the range board might have to be shifted during action, which would be undesirable. In some cases, by reducing the vertical scale of the charts, it is possible to place sets of curves for each projectile and velocity to be used by a particular battery; under these conditions the Range Board, Model 1905, equipped with a percentage correction scale and chart, will be satisfactory. This procedure is practicable for 155-mm. G. P. F.'s, fixed 6-inch, 8-inch and 10-inch guns. It will be satisfactory for 12-inch mortars, as a temporary expedient (paragraph 10 *b*, C. A. B. Project No. 117, *Fire Control Methods for Mortars*). Ultimately mortars and all other armament, except 155-mm. G. P. F.'s and fixed 6-inch, 8-inch, and 10-inch guns, should be equipped with Range Correction Boards, Model E, 1923. It is the belief of the Coast Artillery Board that batteries without the continental limits should be given precedence, and that they should be equipped with Range Boards, Model E, 1923, at the earliest possible date.

18. *Ballistic Range Correction. a.* The ballistic correction is based on variation of conditions affecting the projectile's flight from standard conditions for which firing tables are computed. In computing balistic range corrections the following are taken into consideration: height of site (including tide); wind; earth's rotation; atmospheric density; atmospheric elasticity; projectile weight; and muzzle velocity. The necessity for ballistic range corrections is universally recognized throughout our service, and to a large extent the necessity has been recognized as a result of experience in firing at short ranges. For long-range firing, ballistic range corrections take on an increased importance. In this connection, the following tabulations are of interest:

Caliber	Wt. of Proj.	Velocity	Angle of Departure	Range	Change in Range for Change of		
					10 f. s. in M. V.	1 Percent in C	10-mile Wind
	lbs.	*f. s.*	° ′	*yds.*	*yds.*	*yds.*	*yds.*
			33	1000	7	3	1
155-mm.	95	2410	3 34	5000	30	18	18
			35 11	17000	63	91	221
			24	1000	8	1	1
14-inch	1400	2400	2 39	5000	38	4	5
			20 35	23000	139	85	104
			21	1000	7	0	0
16-inch	2100	2750	1 57	5000	34	4	3
			44 25	44000	278	208	235

b. As compared with pre-war determination of atmospheric conditions, such conditions, in service, are now determined much more accurately. The accuracy of these measurements in service approximates the accuracy of proving ground measurement. The muzzle velocity in service is not measured as it is at the proving ground. Devices for measuring muzzle velocity have not been perfected for use under service conditions, so that the estimate of the muzzle velocity, which must ordinarily be made in service, is based upon very uncertain data. In some coast defenses, muzzle velocities have been measured but the results are of doubtful value. They will remain so until usable facilities are provided for measuring the velocity at each battery. Some officers have questioned the value of firing trial or ranging shots for determining an adjustment of the ballistic correction and then applying the determined adjustment during firing through the medium of the velocity curves on the range correction board. This procedure is advocated by the Coast Artillery Board, and no arguments yet advanced have been sufficient to convince the Coast Artillery Board that for fire at moving naval targets there is any better or more simple procedure. The Coast Artillery Board believes that the best obtainable data for effective fire is obtained by computing a corrected range and azimuth by firing four trial or ranging shots and thereby determining an adjustment to the ballistic correction. For such trial fire a muzzle velocity must be assumed. All other elements affecting the ballistic correction are measured, but are admitted not to be accurately determined.

c. The velocity change due to temperature differing from standard is computed by an approximate formula and gives inaccurate results. The powder charge which will theoretically give a normal velocity is determined under certain standard conditions for the equivalent of a new gun. These standard conditions are never duplicated in service. Two guns will develop muzzle velocities which differ materially, using a powder charge of the same lot. Different storage conditions will cause changes in velocity as is shown by retests of powder. Consequently, we do find in practice that muzzle velocities differ from time to time and from gun to gun. They differ even for the same gun using the same lot of powder on different days. This condition is so well recognized that in Proving Ground firings velocities as determined by measurement on one day are not used on another day, but instead the velocity is remeasured. In the Coast Artillery service, some officers, in considering the error in the ballistic correction as determined by firing trial shots, contend that velocity does not in fact vary sufficiently to account for the errors in the ballistic correction, and hence that the error is not due to velocity, but is due mainly to the effects of some other causes. They attribute the error to retardation, that is, air density, and wind. The Coast Artillery Board does not maintain that the error in the ballistic correction is entirely

due to velocity effects, but it does maintain that velocity is the element which most probably accounts for the major part of any error, and that in practice velocity corrections based on trial shots will place the correction on a curve on the range board which will make the adjustment to the ballistic correction vary with the range in the most reasonable way. Reasonable variations in muzzle velocities are sufficient to account for errors in the ballistic correction, while an unreasonable variation in atmospheric or wind effects must be assumed if the error is attributed to them.

* * * * *

e. Retests of powder frequently show material changes in the velocity to be expected under different conditions of storage, particularly in the tropics. Under service conditions, the muzzle velocity is undertermined in advance of firing. The actual muzzle velocity will be normal because of changes during storage and powder temperature at time of firing. The correction for powder temperature is based upon inaccurate formulæ, so that the correction may be considerably in error. Tests were made at Picatinny Arsenal with three different lots of powder with velocity of 1950 f. s. to determine coefficients of velocity and pressure increase with increase in temperature. The following velocity coefficients were determined:

P. A. Lot 3425	0.93 f. s. per degree F.
D. P. Lot 3466	0.62 f. s. per degree F.
Standard Lot X1416	0.55 f. s. per degree F.

In the Coast Defenses in Panama, available target practice records indicate a powder temperature of about 82° F. The correction for this temperature from the powder chart is 27 f. s., or 1.2%. The correction may be in error by 50% (C. A. B. Project No. 211). This is important since in arriving at an "assumed" muzzle velocity through a powder temperature correction, a material error is introduced. The error is fairly well corrected for if trial shots are fired and resulting corrections incorporated in the muzzle velocity curves.

f. (1) Coast Artillery Board Project No. 114, *Preparation and Adjustment of Fire*, published in the August, 1923, COAST ARTILLERY JOURNAL, showed how a correction applied through the muzzle velocity or atmosphere curves varied. The atmosphere correction curve diverges from the per cent curve in one direction and the velocity curve in the other direction, but the mean is almost coincident with the straight line representing a percentage correction, that is, a correction which varies directly as the range varies.

(2) Whether due to inaccurately determined atmosphere conditions or muzzle velocity, or both, deviations increase with increasing ranges and decrease with decreasing ranges. A correction based on observed deviations, therefore, should be applied in the form of an adjustment of the ballistic correction, and to that element of the ballistic correction most likely to cause error. Unless the muzzle velocity is measured accurately at the battery firing, it appears that muzzle velocity is the element most likely to cause error in the ballistic correction. If the muzzle velocity is so measured, the error in the ballistic correction should be attributed to retardation. A correction should be applied so that its rate of variation will be such as to obviate the necessity for continuous change in the correction due to changes in range. This

will be accomplished for considerable changes in range if the correction be applied on the percentage corrector (see Par. 19) or on the range correction board, either to the retardation curves or to the velocity curves. Unless the muzzle velocity is measured at the battery firing (and this does not appear possible of realization for some time to come), the correction to the ballistic correction as a result of trial or ranging shots should be applied on the range correction board to the assumed muzzle velocity. Four trial or ranging shots are sufficient usually to give a good adjustment of the ballistic correction. It should be noted that both inaccuracies of operation and accidental errors are likely to be less in registration fire, that is, during deliberate firing of trial or ranging shots, than in rapid fire at a moving target. The adjustment to the ballistic correction determined as a result of such firing will usually need to be corrected from time to time as the firing progresses, but it should only be corrected when the evidence of previous shots is outweighed by the evidence of suceeding shots. In practice these later corrections are most readily applied during firing by making corrections on the percentage corrector, which correction will vary through ranges directly as the range varies, until such time as the total correction may conveniently be taken from the percentage corrector and applied through the muzzle velocity curves on the range correction board. During an extensive series of shots the advisability of taking the total correction due to observation of fire as shown on the percentage corrector and applying it when convenient through the muzzle velocity curves to obtain a new ballistic correction should be kept in mind. The methods here outlined are comparatively simple in application. The importance of this is magnified because, in war, batteries will be officered and manned by personnel whose comparatively short training and experience will make *a simple positive procedure very necessary.*

19. *The Percentage Corrector.* *a.* This device was recommended for adoption in Coast Artillery Board Projects Nos. 152 and 170. The device and its operation is described in T. R. 435-221, *Fire Control and Position Finding.* Since the percent procedure is to take a ballistic correction from the range correction board, *the primary function of the percentage corrector is to apply the ballistic correction to the actual range to determine corrected range or elevation.* This device does this simply and quickly. This device becomes the elevation board where guns or mortars fire on elevations instead of ranges. As pointed out above, the percentage corrector provides a simple means of applying the ballistic range corrections and corrections based upon observation of fire so that such corrections vary directly as the range varies.

b. The range-range relation feature, which is another incidental element of the percentage corrector, provides for firing a projectile different from that for which a range drum is graduated. The range-range relation is placed on the range scale of the percentage corrector, so that the proper corrected range for the projectile being fired may be read off as readily as if the standard projectile were being used. This method of handling the range-range relation problem, referred to in Par. 17 *e*, is believed to be more satisfactory than the use of range-range relation tables, which introduce an extra step in obtaining corrected ranges, require more time for operation, and require an extra man for operating them.

c. Some percentage correctors are being manufactured at Frankford Arsenal. At present their use is not prescribed but is authorized. A satisfactory

percentage corrector may be improvised easily from drawings and scales which the Coast Artillery Board furnishes on request. Percentage correctors have been used by a number of Regular and National Guard organizations in drill, subcaliber and service practice, and reports from such organizations show that the device is satisfactory and desirable.

20. *Range Adjustment Board.* *a.* This device was considered in Coast Artillery Board Project No. 132. The device and its operation is described in T. R. 435-221. This device affords an excellent means of figuring the range adjustment correction, showing on what shots it is based, and when applied. The device permits an exercise of judgment in the number of previous shots which should be considered in determining a correction to apply to future shots. It is believed the device is a desirable addition to the fire control apparatus of all batteries since it may be used advantageously with any of the methods of adjustment of fire mentioned in Coast Artillery Memorandum No. 4, and is particularly adapted to the method which appears most logical to the Coast Artillery Board, viz., a correction at any period based on the mean of the deviations of such number of previous shots or salvos as, after consideration of elapsed time and changing conditions, seem to indicate the most probable deviations of the next succeeding shots, if uncorrected.

b. One range adjustment board is being manufactured at Frankford Arsenal. A satisfactory one may be improvised locally from drawings and scales which the Coast Artillery Board furnishes on request. Improvised devices have been used by a number of Regular and National Guard organizations in drill, subcaliber and service practices. Reports from such organizations indicate that the device is satisfactory and desirable, but it is evident that its usefulness would be more apparent in prolonged firing such as may be expected in action.

21. *Deflection Board.* There are two deflection boards in service,—one for mortars and one for guns. There appears to be no reason why a deflection board cannot be made satisfactory for both guns and mortars. In Case III firing with both guns and mortars, since travel during time of flight is considered in determining the setforward point, the deflection board must correct for cross-wind effects, drift, and possibly for effect of rotation of the earth. In case II firing, in addition to cross-wind, drift, and probably rotation effects, it is necessary to correct on the deflection board for travel during the time of flight; and in both Case II and Case III firing it is necessary to provide for arbitrary corrections resulting from observation of impacts. It has been determined that curves of combined drift and cross-wind effects can be plotted, so as to be conveniently used on the mortar deflection board. The whole deflection problem is being investigated in C. A. B. Project No. 87, *Deflection Boards, Experimental (All types of Artillery).* Under this project the Coast Artillery Board is testing Deflection Board, Model E, 1923, which is an experimental board developed at Frankford Arsenal. This deflection board was complicated by providing means for handling deflections in either mils or degrees. This necessity is avoided if sights for all seacoast artillery are graduated for degrees and hundredths, which now seems probable. Assuming this, it is hoped that one type of deflection board can be developed which will be satisfactory for all types of seacoast artillery. A universal deflection board has been developed and is described in the COAST ARTILLERY JOURNAL of May, 1925.—*(To be concluded).*

The National Rifle Team Match

Against a field of eighty-seven entries, the Coast Artillery Rifle Team took seventh place in the National Rifle Team Match on September 18-19. This, the principal event of the year at Camp Perry, Ohio, is open to teams of ten shooting members, two alternates, a team Captain, and a team coach from the several branches of the Army, Navy, Marine Corps, the National Guard of the several states and territories, R. O. T. C. and C. M. T. C. teams from each Corps Area, and civilian teams from each of the several states and territories. Course fired, for each shooting member: slow fire, 200 yards, A target, 10 shots; rapid fire, 200 yards, A target, 10 shots; rapid fire, 400 yards, B target, 10 shots; slow fire, 600 yards, B target, 10 shots; slow fire, 1000 yards, C target, 20 shots.

Results

No.	*Team*	*Captain*	*Score*
1.	U. S. Marine Corps	Major H. L. Smith	2318
2.	U. S. Navy	Lt. Comdr. W. A. Lee, Jr.	2787
3.	U. S. Infantry	Lt. Col. K. T. Smith	2774
4.	U. S. Cavalry	Lt. Col. A. H. Davidson	2756
5.	U. S. Engineers	Capt. J. D. Andrews, Jr.	2742
6.	Illinois National Guard	Major C. H. Davis	2709
7.	U. S. Coast Artillery	Major C. W. Baird	2701
8.	New York National Guard	Lt. Col. F. M. Waterbury	2693
9.	Washington National Guard	Major H. A. Wise	2692
10.	Pennsylvania National Guard	Col. G. E. Kemp	2688
11.	Oregon National Guard	Lt. Col. F. M. West	2684
12.	California Civilian	Ned E. Cutting	2680
13.	Kansas Civilian	J. P. Clevenger	2678
14.	Massachusetts National Guard	Lt. Col. C. C. Stanchfield	2676
15.	Massachusetts Civilian	W. K. Needham	2675

Coast Artillery Team

	Slow Fire			*Rapid Fire*		*Total*
Team	200 yds.	600 yds.	1000 yds.	200 yds.	400 yds.	
Wilson, Charles F., 1st Lt., 6th C. A.	44	47	88	45	43	267
Barnes, Harry C., Jr., 1st Lt. 4th C. A.	45	50	91	45	45	276
Brown, James D., Capt., 14th C. A.	41	48	91	47	45	272
Baird, Clair W., Major, C. A. C.	42	47	94	48	46	277
Loucks, Charles E., Capt., 51st C. A.	47	48	97	47	45	284
Crolick, John, Cpl., Btry. C, 52nd C. A.	40	46	93	48	39	266
McCullough, Samuel, 1st Lt., 51st C. A.	37	48	94	47	46	272
Latiner, David B., 1st Lt., 14th C. A.	41	47	87	44	42	261
Harkrader, Robert, Sgt., Btry. G, 4th C. A.	38	47	84	48	45	262
Simpson, John W., Cpl., Btry. E, 63rd C. A.	40	45	93	44	42	264
Totals	415	473	912	463	438	2701

Team Captain, Baird, Clair W., Major, C. A. C.
Team Coach, Frazer, William D., Major, C. A. C.
Alternates, Mefford, Murrell, Cpl., Hq. Btry., 14th C. A.
Murphy, Willard D., 1st Lt., 63rd C. A.

Artillery Ordnance Development

EDITOR'S NOTE: *The following notes were compiled in the office of the Chief of Coast Artillery by Captain Aaron Bradshaw, C. A. C. Credit is accorded the monthly Digest of Activities of the Ordnance Department for much of the information contained herein.*

MODIFICATION OF 3-INCH A. A. GUN CARRIAGE, M. 1917.—A project was approved June 18 for the modification of one 3-inch A. A. Gun Carriage, Model 1917, in order to test its functioning when equipped with roller bearings around the cradle trunnions. The bearings will be of the self-aligning type manufactured by the SKF Company.

105-MM. A. A. GUN CARRIAGE.—Under date of June 26, approval was given for the manufacture of one 105-mm. A. A. Gun Carriage. This carriage will be tested at the Aberdeen Proving Ground with the 105-mm. Gun which was approved for manufacture under Project No. 25,174.

ANTIAIRCRAFT MACHINE GUNS.—An experimentaal antiaircraft mount for 37-mm. automatic antiaircraft machine guns, known as "37-mm. Antiaircraft Gun Mount, Model 1 E 1," has been completed at Watertown Arsenal and is now at Aberdeen Proving Ground for the purpose of undergoing functioning test.

An experimental antiaircraft machine-gun mount that will accomodate either the .30-caliber or .50-caliber machine gun, but primarily intended for the .50-caliber gun, and which has been designated "Antiaircraft Machine Gun Mount, Model 1925 E," has been completed and is now at Aberdeen Proving Ground undergoing test. This is the third pilot model of mount designed for guns of this type, and in its design efforts have been made to overcome the faults in its two predecessors.

Design of a sight to be used on the 37-mm. A. A. Gun Mount, Model 1925 E, was approved for manufacture on June 26. This is an open sight in which deflections, both vertical and horizontal, can be set off just as they are with a telescopic sight. Deflections are to be transmitted to the gun position from a control station.

Sufficient .50-caliber antiaircraft machine guns have been manufactured to equip completely an antiaircraft regiment, which regiment will conduct intensive training in order to improve their gunnery, and to obtain more data for improvement on the machine guns, tripods, sights, and other accessories used with antiaircraft machine guns.

ANTIAIRCRAFT SIGHTS. — A small number of improved antiaircraft sights have been designed and manufactured for use with antiaircraft machine guns. These sights have proved far more effective than previous sights. As a result of test of these improved sights, additional improvements are contemplated from the results and experience obtained during this test. The percentage of hits has been greatly increased with these sights.

45-CALIBER TRACER AMMUNITION,—Two types of .45-caliber tracer cartridge, one producing a red trace and the other a green trace, have been developed by Frankford Arsenal and were recently tested by the Infantry, Cavalry, Field Artillery, Coast Artillery, and Air Service.

Results of these tests indicated that this ammunition was very effective for night signalling, producing a clear trace for approximately six hundred yards. Experiments conducted during the day, however, indicated that the tracing mixture did not give a sufficient brilliance to be effective for day signalling or for designating targets.

3-INCH A. A. AMMUNITION.—Six thousand rounds of 3-inch A.A. shrapnel, equipped with Type S fuze, have been loaded, assembled and accepted. Orders have been given to Picatinny for an additional ten thousand rounds to be assembled with the Mark III fuze.

Report has not yet been received on the firings to determine the effectiveness of 3-inch A. A. shell against airplanes. Information received from the Proving Ground, however, indicates that the report is now practically complete. Analysis of the fragmentation results with the present Mark I A. A. shell, as compared with the later type (Type E-6), indicates the necessity for repeating the test. It appears that a certain number of effective fragments have probably been lost and have been charged to ineffective fragments too fine to be recovered.

A Protest

A. & M. College, Miss.,
September 14, 1925.

Editor, COAST ARTILLERY JOURNAL,
Fort Monroe, Va.

In your copy of the COAST ARTILLERY JOURNAL for the month of August, 1925, you have an ad of the DuPont Powder Company stating that, "The First American troops to fire French Railway guns in action, were Batteries L and M of the 52nd C. A. C."

I wish to state that DuPont's ad is in error* and am requesting that it be corrected. Copy of letter from the Chief of Coast Artillery setting forth the the fact that Battery "H," 53rd C. A. C., was the organization which had the honor of performing the feat claimed by Batteries L and M of the 52nd.

Your attention is further invited to the primer mentioned in General Barrette's letter, which is mounted in the Officers' Club at Fort Monroe, Va.

Sincerely yours,

GEORGE A. NOWLIN, *Staff Sergeant, D. E. M. L.*
Formerly 1st Sgt. Battery "H,"
53rd Artillery, C. A. C.

(Inclosure)

WAR DEPARTMENT
OFFICE OF THE CHIEF OF COAST ARTILLERY
WASHINGTON

March 13, 1918.

Sergeant Joseph Rhuska,
Gun Commander, Battery H, 53rd Artillery, C. A. C.

Dear Sergeant:

General Coe has sent to me the first primer fired in France by the Coast Artillery. He states that the lanyard was pulled by you at 2:10 P. M., Feb. 14. I want to congratulate you on this event, and to say that I am glad to hear such glowing reports of the brigade.

Very truly yours,

J. D. BARRETTE, *Brigadier General, N. A.*
Acting Chief of Coast Artillery.

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*EDITOR'S NOTE: E. I. DuPont de Nemours & Company, whose advertisements are always very carefully prepared, are withdrawing the text of this advertisement. They state: " * * * The copy for these advertisements, and the sketches which illustrate them, were submitted to the federal officials at Washington, and approval was given to the text and illustrations."

NOV, 1925

Coast Artillery Reserve Units

Data furnished by the Office of the Chief of Coast Artillery.

Organization	*Address of Unit Executive*
Hq. & Hq. Btry., 198th Brigade*	Federal Bldg., Erie, Pa.
Hq. & Hq. Btry., 199th Brigade (A A)	Indianapolis, Ind.
Hq. & Hq. Btry., 200th Brigade (A A)	Federal Bldg., Des Moines, Ia.
Hq. & Hq. Btry., 201st Brigade (A A)	39 Whitehall Street, New York, N. Y.
Hq. & Hq. Btry., 202nd Brigade (A A)	Masonic Temple Bldg., Raleigh, N. C.
Hq. & Hq. Btry, 203rd Brigade (A A)	New Telegraph Bldg., Detroit, Mich.
Hq. & Hq. Btry., 208th Brigade (A A)	39 Whitehall Street, New York, N. Y.
Hq. & Hq. Btry., 209th Brigade (A A)	Army Base, Boston, Mass.
Hq. & Hq. Btry., 210th Brigade (A A)	Unorganized.
Hq. & Hq. Btry., 212th Brigade (A A)	39 Whitehall Street, New York, N. Y.
501st Coast Artillery (A A)	Army Base, Boston, Mass.
502nd Coast Artillery (A A)	39 Whitehall Street, New York, N. Y.
503rd Coast Artillery (A A)	The Lycoming, Williamsport, Pa.
504th Coast Artillery (A A)	Chattanooga, Tenn.
505th Coast Artillery (A A)	Fort Monroe, Va.
506th Coast Artillery (A A)	Federal Bldg., Rock Island, Ill.
507th Coast Artillery (A A)	Ft. Leavenworth, Kans.
508th Coast Artillery (A A)	El Paso, Texas.
509th Coast Artillery (A A)	Seattle, Wash.
510th Coast Artillery (A A)	Chester, Pa.
511th Coast Artillery (A A)	Fort Monroe, Va.
512th Coast Artillery (A A)	Unorganized.
513th Coast Artillery (A A)	39 Whitehall Street, New York, N. Y.
514th Coast Artillery (A A)	State Armory, Schenectady, N. Y.
515th Coast Artillery (A A)	
516th Coast Artillery (A A)	Dauphin Bldg., Harrisburg, Pa.
517th Coast Artillery (A A)	Hq. 9th Corps Area, Presidio of San Francisco, Cal.
518th Coast Artillery (A A)	Hq. 9th Corps Area, Presidio of San Francisco, Cal.
519th Coast Artillery (A A)	Baker-Detwiler Bldg., Los Angeles, Cal.
521st Coast Artillery (A A)	39 Whitehall Street, New York, N. Y.
522nd Coast Artillery (A A)	39 Whitehall Street, New York, N. Y.
523rd Coast Artillery (A A)	Federal Bldg., Erie, Pa.
524th Coast Artillery (A A)	Atlanta, Ga.
525th Coast Artillery (A A)	Indianapolis, Ind.
526th Coast Artillery (A A)	Federal Bldg., Rock Island, Ill.
527th Coast Artillery (A A)	Federal Bldg., St. Joseph, Mo.
528th Coast Artillery (A A)	Minneapolis, Minn.
529th Coast Artillery (A A)	Seattle, Wash.
530th Coast Artillery (A A)	39 Whitehall Street, New York, N. Y.
531st Coast Artillery (A A)	Federal Bldg., LaCrosse, Wis.
532nd Coast Artillery (A A)	Federal Bldg., East St. Louis. Mo.
533rd Coast Artillery (A A)	39 Whitehall Street, New York, N. Y.
534th Coast Artillery (A A)	Masonic Temple Bldg., Raleigh, N. C.
535th Coast Artillery (A A)	
536th Coast Artillery (A A)	New Telegraph Bldg., Detroit, Mich.
537th Coast Artillery (A A)	Minneapolis, Minn.
538th Coast Artillery (A A)	
539th Coast Artillery (A A)	39 Whitehall Street, New York, N. Y.
540th Coast Artillery (A A)	National Guard Armory, Birmingham, Ala.
541st Coast Artillery (A A)	
542nd Coast Artillery (A A)	Portland, Me.
543rd Coast Artillery (A A)	New London, Conn.

* Initials are used as follows after the designation of the unit to indicate armament assignment: A A for antiaircraft; H D for harbor defense: Ry for Railway; and H T for heavy tractor.

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544th Coast Artillery (A A)	Hospital Trust Bldg., Providence, R. I.
545th Coast Artillery (A A)	New Orleans, La.
547th Coast Artillery Battalion (A A)	Unorganized.
548th Coast Artillery Battalion (A A)	Atlanta, Ga.
552nd Coast Artillery Battalion (A A)	Unorganized.
601st Coast Artillery (Ry)	Custom House, Boston, Mass.
602nd Coast Artillery (Ry)	39 Whitehall Street, New York, N. Y.
603rd Coast Artillery (Ry)	Chester, Pa.
604th Coast Artillery (Ry)	
1st and 2nd Battalions	Hq. 9th Corps Area, Presidio of San Francisco, Cal.
3rd Battalion	Seattle, Wash.
605th Coast Artillery Battalion (Ry)	Seattle, Wash.
606th Coast Artillery (H T)	Army Base, Boston, Mass.
607th Coast Artillery (H T)	39 Whitehall Street, New York, N. Y.
608th Coast Artillery (H T)	
1st and 2nd Battalions	Hq. 9th Corps Area, Presidio of San Francisco, Cal.
3rd Battalion	Baker-Detwiler Bldg., Los Angeles, Cal.
609th Coast Artillery Battalion (H T)	Fort Monroe, Va.
613th Coast Artillery (H D)	Portland, Me.
614th Coast Artillery (H D)	Portland, Me.
615th Coast Artillery (H D)	Army Base, Boston, Mass.
616th Coast Artillery (H D)	Hospital Trust Bldg., Providence, R. I.
618th Coast Artillery (H D)	New London, Conn.
619th Coast Artillery (H D)	39 Whitehall Street, New York, N. Y.
620th Coast Artillery (H D)	39 Whitehall Street, New York, N. Y.
621st Coast Artillery (H D)	DuPont Bldg., Wilmington, Del.
622nd Coast Artillery (H D)	Unorganized.
623rd Coast Artillery (H D)	Atlanta, Ga.
624th Coast Artillery (H D)	
625th Coast Artillery (H D)	Baker-Detwiler Bldg., Los Angeles, Cal.
626th Coast Artillery (H D)	Baker-Detwiler Bldg., Los Angeles, Cal.
627th Coast Artillery (H D)	
1st and 2nd Battalions	Hq. 9th Corps Area, Presidio of San Francisco, Cal.
3rd Battalion	Baker-Detwiler Bldg., Los Angeles, Cal.
628th Coast Artillery Battalion (H D)	Seattle, Wash.
629th Coast Artillery (H D)	Seattle, Wash.
630th Coast Artillery Battalion (H D)	Seattle, Wash.
653rd Coast Artillery Battalion (A A)	39 Whitehall Street, New York, N. Y.
Hq. Sound Ranging Service	Chester, Pa.
11th Sound Ranging Battery	Chester, Pa.
12th Sound Ranging Battery	Chester, Pa.
13th Sound Ranging Battery	Chester, Pa.
14th Sound Ranging Battery	Masonic Temple Bldg., Raleigh, N. C.
15th Sound Ranging Battery	Masonic Temple Bldg., Raleigh, N. C.
16th Sound Ranging Battery	Unorganized.
17th Sound Ranging Battery	Unorganized.
Heavy Mobile Artillery Battery (Training)	Unorganized.

The Purpose of Equilibrators

By Captain Aaron Bradshaw, C. A. C.

Equilibrators, which are mechanical devices used for maintaining the balance of cannon at all elevations, are necessary on the present field cannons since the tipping parts of these cannon are not trunnioned at their centers of gravity. When cannon are not trunnioned at their center of gravity some device must be utilized which will overcome the muzzle preponderance and maintain proper balance,

Equilibrators satisfy this requirement and, by maintaining proper balance, make it possible for elevation and depression to be accomplished with the minimum work.

In the past, practically all cannon were trunnioned at their centers of gravity. The recoiling parts of the carriages on which these cannon were mounted generally did not strike the ground when the cannon were fired, since they were short, and, due to their limited range, did not require high elevations.

As the elevation and length of cannon were increased to meet the ever-present demands for greater range, the problem arose of providing space to receive the recoiling parts. The first means devised to prevent the recoiling parts from striking the ground, was to dig a hole to receive them, and this was done and is

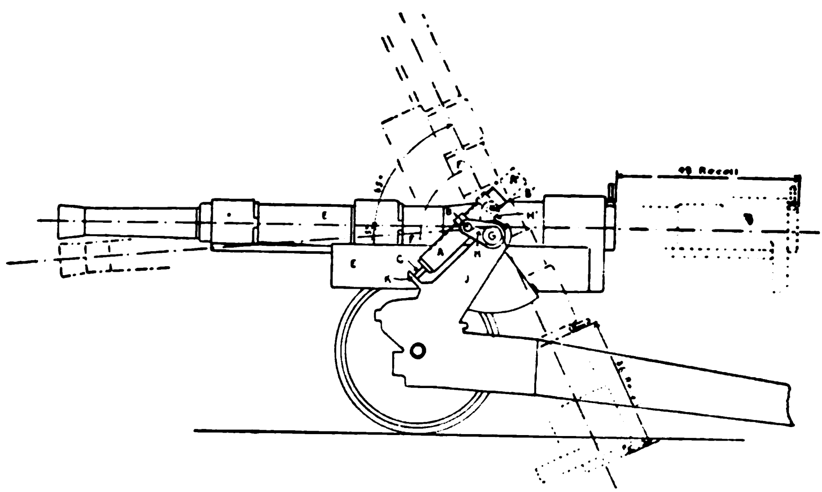

FIG. 1

being done at the present time with old mounts in our service. In the design of the new field mounts considerable study has been given to doing away with this requirement. Three solutions have been seriously considered.

(1) Weighting the breech, which allows for shortening the distance from the breech face to the trunnions without destroying the balance.

(2) Having trunnions at the center of gravity but utilizing a variable recoil system.

(3) Trunnioning the gun in rear of the center of gravity and overcoming the muzzle preponderance by means of equilibrators.

It is maintained that the most practical solution of the problem outlined above is the use of some form of equilibrator and it is believed that in the future all field guns will be equipped with them.

The first equilibrators used consisted mainly of a spring column and a plunger with the spring so adjusted and mounted that it kept the cannon balanced at all elevations. Difficulties were encountered with spring equilibrators due to the fact that the supply of springs was limited due to the severe specifications necessary. This led to the development of a pneumatic equilibrator which is the type now installed on the "155-mm. gun—8-inch howitzer carriage, M. 1920E," and on the "3-inch A. A. gun, M. 1923E."

Figure 1 shows diagrammatically the application of the equilibrator on the "155-mm. gun—8-inch howitzer carriage, M. 1920E." The tipping parts E, with center of gravity at F, are trunnioned at G upon the top carriage J. A pair of arms H, fixed to the trunnion G, receives the equilibrator trunnions at B. The plunger C sockets in the bracket K from the top carriage J. Gravity tends to pull the point F downward about G, which tendency is resisted by the equilibrator through the arm H.

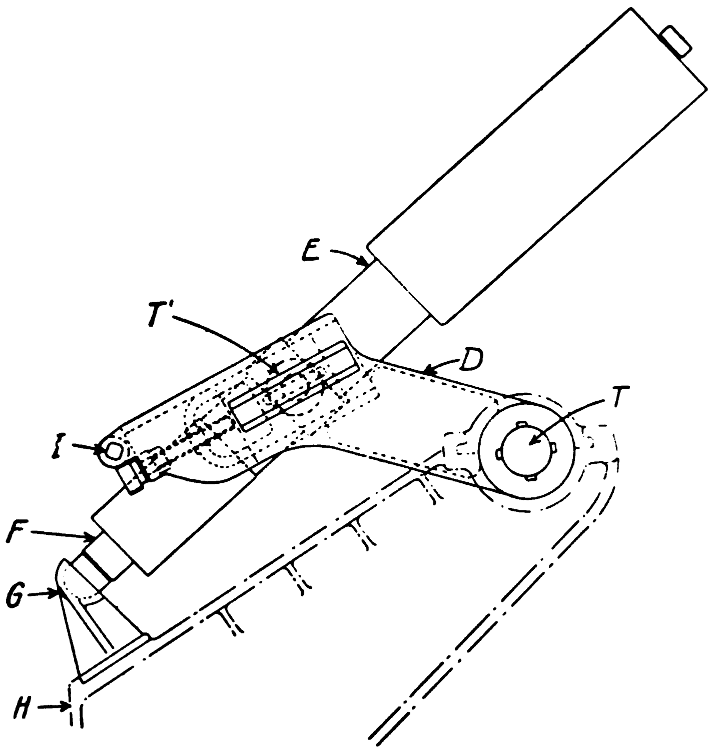

Fig. 2

Figure 2 shows the Pneumatic Equilibrator on the 3-inch A.A. gun mount, Model 1923E. It is of particular interest since it contains absolutely the latest thoughts in equilibrator design. It is designed so that it even takes care of the effects of changes of temperature of the nitrogen used. A brief description of its operation to take care of these effects follows.

The left side view of this equilibrator is shown in Fig. 2. The muzzle of the gun is to the left, and has considerable preponderance. The gun cradle is trunnioned at the point T. Keyed to the cradle trunnion are the arms D which engage a pair of trunnions T′ on the cylinder E. A piston rod F, bearing against bracket G, affixed to the side frame H of the carriage, operates within cylinder E. At the upper end of cylinder E is a volume of nitrogen under initial compression. The pressure of the nitrogen exerted between the upper end of cylinder E and the face of the piston, tend to effect a movement of the trunnions T′ and the arm D, and consequently the cradle and gun, in a clockwise direction

about the center of the trunnion T. The adjustment of the equilibrator having been made for one condition of temperature, subsequent great change in temperature will necessitate readjustment. This adjustment is accomplished by moving the trunnions T′ along the guide ways in the arms D. Such movement simultaneously increases or simultaneously decreases both the lever arm TT′ and the nitrogen pressure, depending upon the direction and amount of such movement. If the equilibrator action is too weak the trunnions T′ are moved downward in the guide ways. If the equilibrator action is too strong the trunnions T′ are moved upward in the guide ways. Movement of trunnions T′ is effected by a combination of worms and screws operated by a wrench on the end of worm shaft I shown in Fig. 2.

Changes in 3-inch Antiaircraft Gun Drill

By 2ND LIEUT. J. E. REIERSON, *C. A. C.*

The following changes in gun drill were made by the writer during the recent test firings at Fort Tilden, New York, and gave very satisfactory results:

Change "Fig. 3—Details, post—3″ Gun Trailer Mount," page 4 of T. R. 435-250 as follows:

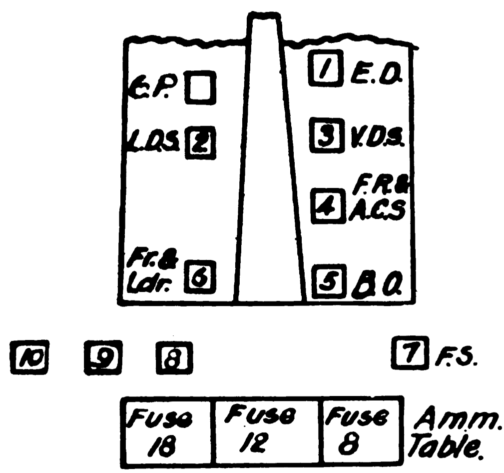

FIG. 3

The gun pointer either *elevates* his sight *to* (or *depresses to*) the burst when firing Trial Shots; for the error in the sight has been determined when the sight is elevated or depressed and the true angular height of the burst can be obtained by correcting the angle of site as read by him. His duties of turning the azimuth pinion knob is dispensed with and instead he traverses the gun (and therefore the sight) as in seacoast guns, because of a recent change made by the Ordnance which locks the pointer, thus causing the gun pointer to traverse the gun to keep his vertical wire on the target. His other duties are as given in T. R. 435-250.

No. 2 (Lateral Deflection Setter) is relieved of traversing the gun. He has the additional duty of traversing back to the azimuth fired on immediately after the projectile leaves the gun, when firing Trial Shots and calibrating, thus eliminating errors in lateral deflection. His other duties are as given in T. R. 435-250.

No. 3 (Vertical Deflection Setter) was relieved of his duty of setting fuze ranges and this duty was given to No. 4.

No. 4 (Fuze Range and Arbritrary Correction Setter) was added, for No. 3 could not set arbritrary corrections (as described in a recent issue) in addition to his other duties. His duties for "Prepare for Action" and "March Order" are the same as given in T. R. 435-250 for No. 4.

No. 6 (Firer and Loader) has all the duties of the Firer and Loader given in T. R. 435-250 for all commands except as noted above.

No. 7 (Fuze Setter) has the same duties as outlined in T.R. 435-250 for No. 8.

No. 8 takes over the duties of the Relayer (No. 7 in T. R. 435-250) for the commands "Prepare for Action" and "March Order" and for all other commands the same duties as Nos. 9 and 10. The Relayer (No. 7 T.R. 435-250) was dispensed with, for it was found that if there were three men in the ammunition detail and each one placed his projectile in the breech the rate of fire could be increased.

Nos. 9 and 10 have the same duties as outlined in T. R. 435-250 except that they take the projectile off the table, cut their own fuze and place their projectile in the breech, approaching the breech from the right rear with their right hand supporting the upper part of the shell and the left the part just above the base so that the hand will not interfere with the loading.

Just before the battery is to commence firing the ammunition will be divided into three piles on the ammunition table and each projectile in its pile will have its fuze cut from "Safe" to a certain fuze. For example the pile nearest the fuze setter will have its fuzes cut to 8, the next pile to 12 and the next to 18. The ammunition detail takes a projectile from the pile which has its fuzes cut just above the fuze coming to the fuze setter. A line was drawn with chalk from the fuze lug (one to be inserted in the fuze slot) down the surface of the projectile so that the proper lug could be inserted more quickly. With the above changes in drill, and methods, a rate of fire of over sixty rounds per battery per minute was obtained.

Table Showing World War Small Arms and Ammunition, Post War Small Arms and Ammunition, and Future Developments

Prepared in the office of the Chief of Ordnance by Major G. P. Wilhelm, *O. D.*

World War Small Arms* and Ammunition

Shoulder Rifles.

U. S. Rifle, Caliber .30, Model 1903.

U. S. Rifle, Caliber .30, Model 1917.

Automatic Rifles.

Browning Automatic Rifle, Model 1917. Used in limited numbers by one or two divisions only.

Machine Guns.

Hotchkiss Machine Gun, Model 1914, 8-mm.

Browning Machine Gun, Model 1917.

Tripod, Machine Gun, Model 1917.

Tripod, Machine Gun, Model 1918.

†Tripod, Browning Machine Gun, Antiaircraft, Model 1918.

†Adapter, Antiaircraft, for Machine Gun Tripod, Model 1917-18.

* Small arms are defined as all calibers up to and including automatic 37-mm.

†Question as to whether they were actually used during the war, but were developed during the war.

Antiaircraft Sights.

None were available during the World War.

Small Arms Ammunition.

Cartridge, Ball, Caliber .30, Model 1906.
Cartridge, Armor Piercing, Caliber .30, Model 1917.
Cartridge, Armor Piercing, Caliber .30, Model 1918.
Cartridge, Tracer, Caliber .30, Model 1917.
Cartridge, Incendiary, Caliber .30, Model 1918.

Post-War Small Arms and Ammunition

Shoulder Rifles.

U. S. Rifle, Caliber .30, Model 1903.
U. S. Rifle, Caliber .30, Model 1917.

Automatic Rifles.

Browning Automatic Rifle, Model 1917.

Machine Guns.

Browning Machine Gun, Caliber .30, Model 1917.
Browning Machine Gun, Caliber .50, Model 1921, Watercooled (without tripod mount).
Tripod, Machine Gun, Model 1917.
Tripod, Machine Gun, Model 1918.
Tripod, Browning Machine Gun, Antiaircraft, Model 1918.
Adapter, Antiaircraft, for Machine Gun Tripod, Model 1917-18.

Antiaircraft Sights.

Sight, Antiaircraft, Front Area, for the .30-caliber Browning Machine Gun, This sight is being modified for temporary use on the .50-caliber machine gun.

Small Arms Ammunition.

Cartridge, Ball, Caliber .30—New Service.
Cartridge, Armor Piercing, Caliber .30, Model 1922.
Cartridge, Tracer, Caliber .30, Model 1923.
Cartridge, Tracer, Caliber .30, Model 1924.
Cartridge, Ball, Caliber .50, Model 1923.
Cartridge, Armor Piercing, Caliber .50, Model 1923.
Cartridge, Tracer, Caliber .50, Model 1925.*

Future Developments

Semi-Automatic Shoulder Rifles.

Three types of semi-automatic shoulder rifles are undergoing development.

Automatic Rifles.

None being developed.

Machine Guns.

None being developed.

An improved tripod for ground use, which can be made immediately available for antiaircraft fire for .30-caliber machine guns, is now being de-

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* Special types of incendiary ammunition have been done away with, as it has been found that the tracer bullets have an effective incendiary effect. *

veloped. Three types are being designed, all involving an effective antiaircraft feature.

An improved antiaircraft tripod which will take either the .30-caliber or .50-caliber machine gun has been designed and will be adopted.

Antiaircraft Sights.

Two types of improved antiaircraft front-area sights for both .30-caliber and .50-caliber machine guns are being designed, the better of which probably will be adopted.

Small Arms Ammunition.

Future development is being devoted to improving the effectiveness of tracer ammunition.

Spotting

By CAPTAIN HARRY R. PIERCE, *C. A. C.*

Such excellent results were obtained this year with a Modified Gray Spotting Board that it is thought worth while to make mention of it.

In the first place a regular Gray Board was used, scale 300 yards to the inch for Service Projectile and 100 yards to the inch for the Sub-Caliber Projectile, one scale being graduated on one side of the board and one on the other. Two target blocks were used, one for service and one for sub-caliber with same respective scales.

The modification consisted in using celluloid protractors seven feet long instead of the strings and triangles originally designed. These protractors were made from automobile window celluloid graduated their entire length with lines 0.25 degree apart in reverse of the division in the azimuth instrument or from left to right, 3.00 in the center. The center, or 3.00 line, was inked in red, the other even degree lines black, and the rest green.

Only one man was used to operate the board. This was the greatest advantage because, while it is a great problem, with our customary shortage of personnel, to find three or four extra men capable of performing satisfactorily this important work, it is usually possible to utilize one good man for it.

The one Spotter wore a head set to which were connected, in parallel, three lines,—Plotting Room, B′ Spotting Observer, and B″ Observer. During dull moments the Spotter called to the plotting room for ranges and azimuths. Then when the splash came the phone conversation was so synchronized that B′ called out his deviation first, quickly followed by B″. The Spotter, who had his B′ protractor underneath the B″ protractor, then set the B′ deviation of the protractor over the center of the target block and, while holding this protractor with his hand, set the B″ in the same manner. The intersection of the red lines showed him the splash at once which was repeated in yards to the B′ Station, also in this case the B. C. Station.

Deviations arrived at the B. C. Station from five to ten seconds after the splash. Of six shots that were fired the greatest error made by the Spotter was fifteen yards and the least error five yards. The 15-yard error occurred on a salvo which was reported as a hit, the center of impact of which however was fifteen yards from the target. The mean error was eight yards.

The advantages of this modification may be summed up in one remark. It takes only one man, and for a job like that, one good man can always be found.

Coast Defense Troops

Seacoast defense is provided for in several different ways by different nations. In Japan, Great Britain and Italy, the army is charged with the operation of the coast defenses, while in France coast defense control is under the naval ministry which, for this purpose, disposes of elements belonging to the war ministry.

In Italy, fixed defense troops are part of the army and are called coast artillery *(artiglieria da costa)* and heavy artillery *(artiglieria pesante)*. These two organizations are not considered as a separate branch, but form part of the Italian artillery which is composed of field, heavy field, mountain, coast and heavy, and antiarcraft artillery. A general officer acts as chief of all artillery. Officers of artillery theoretically are trained for service with any of the above groups; in practice, officers are permitted to specialize for service with that type of artillery which they prefer and for which they are best qualified.

The potenial strength of our present military system, Regular, National Guard and Organized Reserves, can only be visualized by those who work with it today and who in 1917 witnessed the dilemma of the War Department. Great cantonments will no longer be necessary, even camps may be avoided. The basic organization is constituted HERE, — THERE, in every hamlet in the country, and the officials, as general managers and foremen, are in place. By a single directive the process can be set in motion of assembling and training locally the patriotic citizen for the defense of his country. If we maintain this system, no longer in a national crisis should our young men depart for unknown battlefields under partially trained officers. The leaders of this force today are veterans of the World War who, with splendid spirit, have continued voluntarily to devote themselves to this service. Their successors are being provided from the youth of the country, through the summer training camps, and through the Reserve Officers Training Units established in many of our schools and colleges.
—General Pershing, at Pittsburgh, April 26, 1924.

MILITARY NOTES

furnished by

THE MILITARY INTELLIGENCE DIVISION, G. S.

Russia

DETAILS OF FEDOROFF MACHINE GUN.—A recent number of a German military publication gives the following details of the light machine gun recently adopted for the Red Army.

This gun, called the Fedoroff after its inventor, weighs only five kilograms and has a caliber of 6.5 mm. It has a movable barrel and a breech consisting of two bolts, one on each side. The magazine holds 25 rounds. The ammunition is of Japanese manufacture which is reported to have been found more suitable than that of Russian make for the gun.

The initial velocity is 680 meters and the rapidity of fire is 25 rounds per minute, individual fire, and from 75 to 100 rounds, rapid fire. There is no provision for cooling the gun.

Poland

ARMY MANEUVERS.—The first Polish Army maneuvers carried out since she gained her independence ended August 20, 1925. The general idea was "a defensive force guarding the frontier."

The first part of the maneuvers took place in Volhyna, near the town of Brody. Fifteen thousand troops were engaged. This was mainly a Cavalry maneuver. It represented a type of open warfare, which was required by geographical conditions of the eastern borders.

The second part of the maneuvers took place in Pomerania, near Thorn. This consisted chiefly of Infantry and Artillery operations under modern conditions.

Both maneuvers were attended by General Gouraud, representing the French, and General Ironside, representing the British.

The Polish troops have shown during the recent maneuvers remarkable fitness, and in the first part of the maneuvers, which lasted three days, and while tropical heat was prevailing, only 32 men out of 15,000 reported sick. The foreign guests, including General Ironside, paid high compliments on the training of the soldiers and the initiative shown. Representatives of the armies of Great Britain, France, Italy, Japan, United States, Spain, Sweden, Finland, Esthonia, Latvia, Roumania, Ccechoslovakia, Serbia, and Turkey were present at the maneuvers.

Spain

Permanent Army in Africa.—The new organization of the Spanish permanent army in Morocco is as follows:

Spanish Troops

	Officers	*Cont. Empl.*	*Enlisted*	*Animals*
Infantry	1,201	74	41,975	6,982
Cavalry	159	12	3,523	3,858
Artillery	351	178	10,521	4,381
Engineers	196	22	7,929	1,423
Q. M. Troops	73	44	3,301	1,931
Medical Dept.	132	18	2,252	655
Veterinary	73			
Chaplains	33			
G. S. (Topographical, etc.)			49	
Sea (Stevedores) Cos.			488	
Aviation	56		415	
Total	2,274	348	70,453	19,230

Foreign Legion *(El Tercio)*, amounting to 252 officers and 8,048 enlisted, are included in Infantry, above. 383 officers and 63 clerks, in addition to the forces indicated above, are also attached to the administration of the protectorate.

Native Troops

Officers	*Enlisted* Inf.	*Enlisted* Cav.	*Animals*
450	10,876	2,180	3,871

There also exist five Groups of *Mehallas* or native troops commanded by Spanish officers, maintained by the Jalifa or Moorish Government. Their strength is variable.

Several *Harcas* or native fighting troops, friendly to Spain, commanded by prominent Moors or Spanish officers, and under the supervision of Spanish officers are actually cooperating in the security of the territory.

The above is the *permanent* Army of Africa. It is now and has generally been reinforced by "expeditionary" units sent from the Peninsula.

Italy

Artillery Organization.—The Italian Artillery, as at present organized, comprises field artillery *(artiglieria da campagna)*, heavy field artillery *(artiglieria pesante campale)*, and horse artillery *(artiglieria a cavallo)*.

The field or divisional artillery consists of twenty-seven regiments nominally alloted to twenty-seven of the thirty existing divisions. The three divisions which have no field artillery regiments of their own are stationed along the mountainous northern frontier.

The light regiment consists of twelve batteries (four of which are cadre batteries in peace), organized into four groups or battalions and a depot. Batteries are all equipped with four guns and are horse-drawn, but the different groups have different caliber weapons. The first two groups are armed with the 75-mm.

Deport gun, model 1911; the third has 100-mm. Austrian howitzers; and the fourth is pack artillery armed with either the 65-mm. or 75-mm. model 1913 Skoda mountain guns. Each group has also two antiaircraft machine guns. The first three groups have four horse-drawn ammunition wagons per battery.

The heavy field artillery is corps artillery and consists of fourteen regiments of four groups each. Each group has two active and one cadre battery of four guns. The first and second groups are armed with 105-mm. guns, the third and fourth with 149-mm. howitzers. Each battery has two antiaircraft machine guns. The transport of the guns and of the entire regiment is mechanical.

The so-called horse artillery consists of one regiment with two groups of horse artillery each of two 4-gun batteries and two groups of mechanically drawn or carried artillery each of two 4-gun batteries and one cadre battery. The horsed batteries have the 75-mm. 1906-12 gun; the mechanized batteries, the 75-mm. 1911.

France

The Infantry Division.—The French infantry division consists of 470 officers, 16,650 men, 5,700 horses, 1,400 horse-drawn vehicles, 38 motor cars, and 120 motor trucks.

For purposes of study, the division may be divided into the following component parts:

	Officers	*Men*	*Horses*	*Vehicles Horse*	*Vehicles, Motor*	
					Cars	*Trucks*
General Headquarters	50	240	70	5	12	13
Troops	383	15.140	4,880	1,194	18	30
Services	39	1,260	760	205	8	77

The Troops consist of the following:

Infantry: 3 regiments of 3 battalions each; 1 pioneer battalion of 4 companies; 1 instruction center, constituting a small reserve of troops and specialists.

Reconnaissance Group: 1 troop; 1 cyclist company; 1 machine gun platoon (motorized).

Artillery: 1 75-mm. regiment of 3 groups (battalions); 1 155-mm. regiment of 2 groups; 1 instruction battery.

Engineers: 1 battalion of 2 mining sappers.

Signal: 1 telegraphist company; 1 radio-telegraph detachment.

Air: 1 aeronautical company; 1 sound post.

The Services comprise the following:

Artillery: 1 ammunition section, horse-drawn, artillery; 1 ammunition section, horse-drawn, infantry; 1 ammunition section, motorized, artillery; 1 labor company.

Engineers: 1 park company.

Quartermaster: 1 procurement group; 1 section for care of cattle; 1 revictualing section.

Medical: 1 mixed sanitary group; 1 sanitary section, motor; 1 mobile veterinary evacuation section.

Train: 1 motorized company; 1 horse-drawn company.

DETAILED ORGANIZATION OF INFANTRY AND TANKS.—The following are the fundamental Infantry and Tank organization tables by which larger units are constructed:

INFANTRY

Elements	Effectives		Horses	Horse-drawn Vehicles	Motors	
	Officers	Men			Touring	Others
Rifle Company	4	185	7	8		
Machine-Gun Company	4	160	40	30		
Section of Accompanying Weapons	1	70	15	12		
Infantry Battalion	20	800	80	46		
Infantry Regiment	70	2800	400	200	1	2 side cars
Battalion of Chasseurs a Pied (Light Inf.)	22	900	120	60		
Staff of the ½ Brigade of Chasseurs and Headquarters Company	12	150	80	25	1	2 side cars
Company of Machine Gun Chasseurs	8	190	84	25		
Battalion of Machine-gun Chasseurs	20	900	200	120	1	2 side cars
Cyclist Company of Div. or Corps	4	150	10	5		8 light trucks
Pioneer Company	8	250	5	2		
Pioneer Battalion	16	1000	40	18		
Pioneer Regiment	66	4100	170	70		
Division School	16	650	35	15		

The Rifle Company consists of 1 section of command and 4 combat sections. The Machine-gun Company has 4 sections of 2 groups with 2 guns and 1 command section. The Section Accompanying Weapons consists of 2 groups; 1st group has 3 pieces, 37-mm. guns; 2d group has 3 mortars. This section is part of the Regimental Headquarters Company.

The Infantry Battalion consists of 1 staff, 1 section of command, 1 reserve of command (4 warrant officers and 10 corporals), 3 rifle companies, and 1 machine-gun company. The Infantry Regiment consists of 1 staff, 1 section of command, 1 platoon of 25 mounted men, 1 headquarters company, and 3 battalions.

The Battalion of Chasseurs consists of 1 staff, 1 command section, 1 headquarters company with 3 sections, 1 reserve of command, 3 rifle companies, and 1 machine-gun company. The ½ Brigade of Chasseurs a Pied consists of 1 staff, 1 section of command, 1 platoon of 12 mounted men, 1 headquarters company with 4 sections, and 3 battalions of chasseurs a pied.

The Chasseur Machine-gun Company has 3 combat sections and 1 section of command. The Chasseur Machine-gun Battalion consists of 1 staff, 1 section of command, 1 headquarters company, 3 chasseur machine-gun companies, 1 rifle company—composed of 3 platoons,—and a reserve of command (4 warrant officers and 10 corporals).

The Cyclist Company has 3 combat sections of 3 groups each, 1 machine-gun group (cavalry type), and 1 section of command.

The Pioneer Company has 1 section of command and 4 sections of pioneers. The Pioneer Battalion has 1 staff, 1 section of command, and 4 pioneer companies. The Pioneer Regiment has 1 staff, 1 section of command, and 4 pioneer battalions (no headquarters company).

The Division School consists of 1 staff, 1 section of command, 1 instruction company of 4 sections for each regiment of Infantry making up the Infantry Division. The instruction company of a ½ brigade of chasseurs is made up by uniting the 3 detachments belonging to each of the battalions of the ½ brigade.

Tanks

Units	*Officers*	*Men*	*Tanks*	Motor Transport	
				Trucks Touring	*Cars*
Co. of Light Tanks	4	110	21	1	2
Service Co. of Battalion	3	65	3	1	10
Battn. of Light Tanks	18	400	66	6	18
Regt. of Light Tanks	40	1000	132	17	100
Battn. of Heavy Tanks	60	950	Heavy 45 Light 9	12	74
Company of Heavy Tanks	20	260	Heavy 15 Light 3	1	30

Notes on Above Organizations

The Company of Light Tanks is composed of 3 Sections of 5 light tanks (2 tanks with 37-mm. guns and 3 with machine guns), plus 5 supply and wrecker tanks (for helping out of trouble tanks unable to get out under their own power), and 1 command tank for Major commanding Co. (equipped with cannon). The Supply Company of the battalion is composed of 3 Sections: 1 section of transmission with 3 tanks equipped with wireless, 1 workshop section, and 1 section for supply.

The Battalion of Light Tanks is composed of 1 staff section, 1 command section, 1 supply company of battalion, and 3 companies of light tanks. The Regiment of Light Tanks is composed of 1 staff section, 1 command section, 1 supply company, and 2 battalions of light tanks.

The Battalion of Heavy Tanks is composed of 1 staff section, 1 command section, 1 supply and wrecker section, and 3 companies of heavy tanks. The Company of Heavy Tanks is composed of 3 combat sections of 4 heavy tanks each, 1 section of supply composed of 3 heavy tanks and 2 light tanks, and 1 light tank for Major commanding.

Principal Characteristics of Weapons

Weapons	*Maximum Range*	*Effective Range*	*Shots per Minute*	*Remarks*
Hand Grenade		30 m.		*In grazing fire. In indirect fire the effective range is up to 3500 m. Beyond 1000 m. grazing fire can only be effective on important objectives.
Rifle Grenade (V. B.)		100 m.	8 to 9	
Automatic Rifle	4200 m.	600 m.	120	
Rifle	4200 m.		8 to 10	
Machine-gun	4300 m.	800 to 1000 m.*	250	
37-mm. Gun	2400 m.	1500 m.	20	
Mortar	2000 m.	1000 m.	15 to 30	

COAST ARTILLERY BOARD NOTES

Communications relating to the development or improvement in methods or materiel for the Coast Artillery will be welcome from any member of the Corps or of the service at large. These communications, with models or drawings of devices proposed, may be sent direct to the Coast Artillery Board, Fort Monroe, Virginia, and will receive careful consideration.—R. S. Abernethy, *Colonel, C. A. C., President Coast Artillery Board.*

New Projects Initiated During the Month of September

Project No. 391, Stability Test of 3-inch Antiaircraft Gun Mount, Model 1923-E.—The Chief of Ordnance is conducting a number of experiments with 3-inch antiaircraft gun mount, Model 1923-E, before undertaking permanent modifications to correct the difficulty as to stability. In order to save time and expense of shipping the mount back to Aberdeen Proving Ground he requested that these experiments be conducted at Fort Monroe. The Chief of Coast Artillery directed that the Board emplace this mount as requested.

Project No. 392, Percentage Corrector With Interpolator.—One of the percentage correctors with interpolator attached, which was manufactured at Frankford Arsenal, has been sent to the Coast Artillery Board. The Board has been directed to arrange to have this device tested by troops at Fort Monroe at drills and during such target practices as may be held during the next few months.

Project No. 393, Fire Control for 14-inch Railway Gun, Model 1920.—The 14-inch Railway Gun, Model 1920, is to be shipped to the Harbor Defenses of Los Angeles. The Ordnance Officer of those defenses has requested the Coast Artillery Board to submit a list of proposed equipment for use in the fire control system.

Project No. 394, Requirements for Short Range Radio Telegraph Set.—The Chief of Coast Artillery has directed the Board to investigate and report on the specific requirements to be met in an easily transportable, short-range radio telegraph set for use with distant subposts of the antiaircraft information service that cannot conveniently be included in the telephone net.

Completed Projects

Project No. 390, Predicting Targ Setforward Device.—

Editor's Note: *The following report of the Coast Artillery Board on Project No. 390 was furnished from the office of the Chief of Coast Artillery. The* Journal *considers that the Coast Artillery needs a universal predicting targ that will permit more rapid plotting without sacrifice of accuracy, and hopes that publication of Project No. 390 will stimulate further discussion and development in the solution of the problem.*

I—History of the Project.

1. The following is quoted from letter OCCA 353. 17/27-I:

(1) There is attached herewith a copy of the target practice report submitted by Battery B, 7th Coast Artillery (Hr. Det.) of the firing held at Battery Kingman, 12-inch B. L. R. Barbette Carriage.

> (2) It is requested that this report be commented upon by the Coast Artillery Board, particular reference being made to mechanical devices described on page 11 of the report.

2. The following is quoted from page 11 of the target practice report above referred to:

> (3) Two special mechanical devices were utilized during the practice. A predicting targ and a special form of setforward ruler.
>
> (a) The predicting targ was designed to replace the usual standard targ and to eliminate some of the steps in predicting the setforward point. The device, the dimensions of which were made for the 110° plotting board (long range), consists really of two targs, capable of being displaced one from the other by a scale distance equal to the linear travel of the target during the predicting interval (30 seconds) plus the time of flight. The

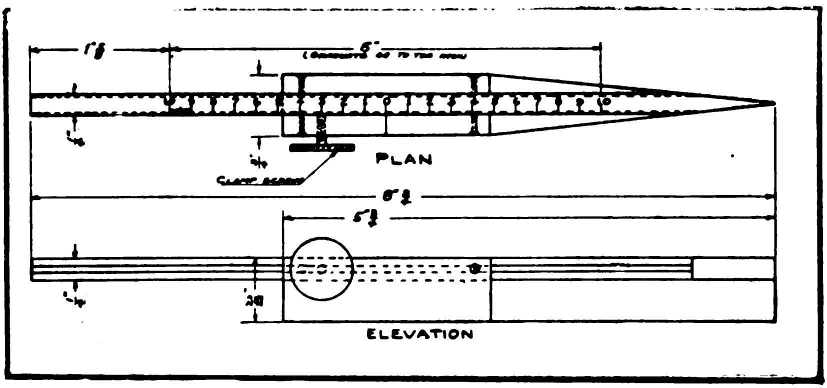

Fig. 1

> lower portion is of a height equal to the combined thickness of the two station arms plus a slight clearance while the upper portion is graduated to the scale of the plotting board and can be set up to 800 yards in front of or in rear of the lower portion. In operating the targ the assistant plotter, with the aid of a special form of setforward ruler, keeps the two portions set with respect to each other so that the targ apices are always separated by the linear travel of the target during the predicting interval plus the time of flight. When the arm-setters have called "set," the plotter brings the lower apex against the intersection of the station arms, aligns the targ with the course of the target and then brings the gun-arm up against the upper apex and immediately calls off the setforward range in the same time it would have taken to determine the last plotted range. After the setforward azimuth has been noted by the azimuth corrector the plotter causes the station arms to be cleared, and with a pencil marks the plotted point, and if there has been any change in travel he so notifies the assistant plotter. An alternate method is to mark the plotted point with the standard targ before the arms are cleared.
>
> (b) The special setforward ruler referred to above is constructed of white opaque celluloid and consists of two concentric discs of different radius. The upper and smaller disc's periphery is graduated in logarithmic values of the travel in yards during the predicting interval, whereas the lower and larger disc is graduated in logarithmic values of setforward travel. The time of flight scale is not graduated in seconds but in corresponding ranges for the 12" B. L. R., Model 1895. In operating the rule, its index is set opposite the travel in 30 seconds and the setforward travel is read opposite the range.

3. The following is quoted from letter from Captain Albert M. Jackson, 7th Coast Artillery, to the Coast Artillery Board, dated August 15, 1925:

> It will be noted that the predictor is good only in cases where the target is traveling at an angle greater than 6° from either of the arms.

4. The "Predicting Targ" was sent by Captain Jackson to the Coast Artillery Board for examination. A drawing of it is appended hereto and marked "Exhibit A" (See Fig. 1).

5. The Coast Artillery Board made a study of the target practice report of Battery Kingman with particular reference to the "Predicting Targ" and setforward ruler and examined the "Predicting Targ."

II—Discussion.

6. *a.* (1) The "Predicting Targ" does cut down the time required to find range and azimuth of the setforward point; but it accomplishes this at the expense of accuracy. This is so because the travel used in setting the "Predicting Targ" is not the travel during the last observing interval but is the travel during the next to last observing interval. The resulting error will be negligible when target is moving at a slow rate of speed and changing its course but slightly; but this error cannot be neglected when the target is moving rapidly and on a continuously changing course.

(2) Predicted track of target cannot be made properly without taking into consideration the last plotted point. With the "Predicting Targ" the last plotted point cannot be used effectively when course of target changes appreciably.

(3) The "Predicting Targ" cannot be used when target is traveling at an angle of less than 6° from either of the arms.

(4) The "Predicting Targ" is not universal in that it is not adaptable for use with the Cloke Plotting Board.

b. The setforward slide rule is correct in principle, accurate, and easily constructed. It does not seem to possess any particular advantage over other methods at present in use for solving the same problem.

III—Conclusions.

6. The Coast Artillery Board believes that neither the predicting targ nor the setforward slide rule considered meets the requirements of a standard fire control instrument for Coast Artillery use; but that these devices will be satisfactory in special instances.

7. The Coast Artillery Board recommends that the "Predicting Targ" and setforward slide rule be not adopted for Coast Artillery use; but that their use be permitted where desired.

COAST ARTILLERY SCHOOL LIBRARY

BOOKS CATALOGUED

Unless marked thus "*" these books may be obtained by any Coast Artillery Officer; Warrant Officer, A. M. P. S.; or Non-Commissioned Officer (Grades 1-3), C. A. C., upon request to the Librarian, C. A. S. Library:

American Society of Civil Engineers. *Transactions, Vol. 88.* 1925.

Adjutant General's Office. *United States Army Training Manual, Nos. 1, 2, and 4.* 1922-25.

Adkins, F. J. *Historical Backgrounds of the Great War.* 1919. 292 p.

Air Service Tactical School. *Combat Orders, Course 1924-25.* 69 p.

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**All the World's Air-Ships.* 1925.

**Almanach de Gotha.* 1925.

Army Service Schools. *Troop Leading; An Infantry Division in Attack.* 1921. 236 p.

American Enthnology, Bureau of. *Annual Report.* 1918.

Ardant du Picq, C. J. J. J. *Battle Studies.* 1921. 273 p.

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BOOK REVIEWS

The Eclipse of American Sea Power. By Captain Dudley W. Knox, U. S. N., retired. The American Army and Navy Journal, Inc. 1922. 5¼"x 7¾". 140 pp.

During the Washington Conference the American delegates refused to give out any news. This matter was left entirely to the British publicity agent. The delegates adopted this policy to prevent the creation of any suspicion that they were using their press to turn public opinion against any nations with whom difficulties might arise. One unfortunate result of that honorable policy was that the American press, and therefore the American public, was dependent upon foreign sources for an interpretation of issues involved. Specifically, no authoritative American version of the proceedings was available. The author of this book offers a professional interpretation of the conference proceedings.

The points advanced are, briefly: (1) that at the beginning of the Conference, due to our active building program and our relatively superior financial ability to pursue such a program, we were in a position to develop a naval power equal to or superior to that of any other nation; (2) that, although the Conference agreement as to capital ships placed us on par with Great Britain, our actual strength, with capital and other naval vessels, naval bases, and naval reserves considered, is not even a close second to that of Britain; (3) that the restriction against further fortification of American Naval bases in Far Eastern waters has reduced our battle strength there far below that of Japan; and (4) that partial limitation of naval armament, in itself, is no guarantee against further naval competition.

The author concludes that sacrifices made by America are far out of proportion to those made by any other power and emphasizes the necessity for keeping our navy up to conference strength, particularly as to personnel. The author's arguments are not radical or new. His views are in line with accepted American Naval doctrine.—C. S. H.

A Chapter of Misfortunes. By Major General W. D. Bird, C. B., C. M. G., D. S. O. Forster, Groom & Co., London. 5¾"x 8¼". 288 pp. 8*s*.6*d*.

This book deals with the campaigns in Mesopotamia during the fall and winter of 1915-1916,—when British statesmen first resolved, from military and political motives, to capture Bagdad. The narrative is principally devoted to events leading up to the battle of Ctesiphon and its failure, to Townsend's withdrawal to Kut-el-Amara, its occupation and defense, the battle of Dujailah, and events leading to the final surrender of Kut-el-Amara in April, 1916. It is written pricipally from diaries kept by individuals participating in the campaigns.

The story is one of a complete failure. Almost suddenly the British invading force was halted from a campaign of brilliant minor successes and thrown

back into a series of misfortunes. Not unlike scores of other military campaigns, it was one where movement was an essential to success; but due to the nature of the country transportation depended tremendously upon the weather and seasons. And there the British campaign failed.

There is an example of lack of proper coordination among the commanders and an outstanding instance of incorrect interpretation of military intelligence on the part of the British. The Turks, directed by a German staff, turned to advantage weather, time, tide, and terrain. The British operations about Kut-el-Amara and to the south were held up, hindered, and finally squashed by an enemy who turned to his aid the flood waters of the Tigris.—C. S. H.

Vauban, Builder of Fortresses. By Daniel Halévy. Translated by Major C. J. C. Street, O. B. E., M. C. The Dial Press. 1925. 6"x 8½". 256 pp. $2.75.

Few military engineers leave works of such lasting value that they are employed in the defense of their country after a lapse of two centuries. Vauban, Marshal of France, prepared in 1680 the sluices to inundate the lowlands of Nieuport and Dixmude utilized by the engineers of 1914 to stem the gray horde.

Vauban is the greatest modern master of the art of fortification. M. Halévy, in describing the untiring efforts of this exceptional man to establish the defense of France and render her safe from invasion, deals altogether with his personality and his rise from poverty to the exalted position of Marshal of France. For the technical details of his works one must search elsewhere.

The fluency of M. Halévy's style loses nothing in Major Street's translation. The biography commends itself to the reading of those followers of the profession of arms who, today, should study the lives of our famous predecessors of yesterday.—B. F. H.

Famous American Statesmen. By Sarah K. Bolton. Thomas Y. Crowell Co. 1925. 5½"x 8". 378 pp. $2.00.

Mrs. Bolton has given a most interesting outline of United States history from the Revolution through the World War. For her framework she has taken fourteen of the nation's most valuable possessions—her great men. These she has presented as human beings with all of the joys, sorrows, successes, and failures common to humanity. In sketching their lives she has related history during the most vital times through which our country has passed. She carries each one from his birth to his death in such an interesting manner that the reader will not willingly lay the book aside until a section has been completed.

The men she has chosen are George Washington, Benjamin Franklin, Thomas Jefferson, John Adams, Alexander Hamilton, John Marshall, James Madison, Andrew Jackson, Daniel Webster, Henry Clay, Abraham Lincoln, John Hay, Theodore Roosevelt, and Woodrow Wilson.

These human sidelights of United States history will be interesting and instructive to both the casual reader and the student of history.—H. B. H.

Two Ordeals of Democracy. By John Buchan. Houghton, Mifflin Co. 1925. 6"x 8¾". 56 pp. $2.00.

Colonel Buchan, an Englishman, delivered this lecture at Milton Academy on the Alumni War Memorial Foundation on October 16, 1924.

His theme is the necessity for individual decision in traveling the path of duty and courage and devotion. This he has treated by a brief review of the decisions required before and during our Civil War. He highly commends the wise decisions of President Lincoln. "You will all be called upon some day to face situations in public or private life where you will have to choose between two ways * * * and you will have to choose alone."

The work is easily recognized as that of a well-informed student of military history and, although brief, is interesting. Throughout his discussion of the Civil War he makes constant comparisons with the World War and other conflicts.—H. B. H.

Ten Years After. By Philip Gibbs. George H. Doran Co., New York. 1925. 6"x 9". 246 pp. $2.50.

We have here a survey of world conditions for the past ten years Armed with a wide knowledge and equipped with an extraordinary insight into human affairs, the author wades through this turbid period of world history, weighing conflicting opinions and facts, and emerges to present in lucid form some of the baffling problems which the more advanced nations must face if they wish to consummate the period of world reconstruction. Incidentally he draws attention to some of the outstanding diplomatic and political blunders made during the period of his survey. The Treaty of Versailles is awarded sharp criticism. Few matters of importance escape his attention.

The book includes four parts,—The World War, The Uncertain Peace, The Present Perils, The Hope Ahead. The following partial list of subheadings may serve to indicate the scope of the book: The Sense of Peace, The Call to Courage, The Spirit of the Victims, Fading Memories, The British Illusion, The Occupation of the Ruhr, The Revival of Hope.

The pages devoted to The Spirit of the Victims stamp Philip Gibbs as an able student of pschychology. The lesson driven home is one that the army officer would do well to learn early in his service,—the spirit of the battalion when the leader has blundered.

The pages are filled with food for thought. The style is appealing. "Ten Years After" can hardly fail to attract wide attention.—C. S. H.

History of the Philippines. By David P. Barrows, Ph. D., LL. D. World Book Co. 1924. 5"x 7½". 406 pp. Illustrated. $1.60.

Doctor Barrows, now Professor of Political Science in the University of California, has held the following offices in the Philippines: City Superintendent of Schools in Manila, Chief of the Bureau of Non-Christian Tribes of the Philippines, and Director of Education for the Philippines.

His work was written for Filipino students seeking information, not only of their own race and island home, but of the place of that race in the history of the Far East and of Europe. It was first produced in 1901-1903. The present edition was revised and published in 1924.

Fourteen chapters cover the history of the Islands and their people under the following headings: The Peoples of the Philippines; Europe and the Far East about 1400 A. D.; The Great Geographical Discoveries; Filipino People before the Arrival of the Spaniards; The Spanish Soldier and the Spanish Missionary; Period of Conquest and Settlement, 1565-1600; The Philippines Three Hundred Years Ago; The Dutch and Moro Wars, 1600-1663; A Century of Obscurity and

Decline, 1663-1762; The Philippines During the Period of European Revolution, 1762-1837; Progress and Revolution, 1837-1897; America and the Philippines; A Decade of American Government, 1903-1913; Toward Independence, 1914-1924.

The history of the Islands proper is paralleled by enough of the European history of the time to show how the latter influenced local conditions. The author has been just throughout the text but has not failed to place blame where it is due. The last chapter, dealing with the independence issue, is particularly interesting. A study of this concise history will help materially in the understanding of the problems of the Philippines.—H. B. H.

The Isles of Fear. By Katherine Mayo. Harcourt, Bruce and Company, New York. 1925. 6"x 9". 372 pp. Ill. $3.50.

Here is "The Truth About the Philippines," as seen by the author from a first-hand study.

It is pointed out that there is really no Filipino race. There are forty-three tribes, speaking eighty-seven distinct dialects which inhabit about two-thirds of 3141 islands. The population is:

a. The mountain people of the Island of Luzon, composed of several distinct people.

b. The Mohammedans (Moros) of the Southern Islands.

c. The Christian Filipino.

The first two resent being considered Filipinos.

The Filipinos are of two classes "the *cacique* or moneyed class, which bosses, and from which all politicians come; and the *tao,* or peasant class, which is bossed, and which has, in practice, no voice whatever in governmental or political affairs. The *cacique* class numbers perhaps six per cent of the total, and rests, not upon inherited position, but wholly upon the grip of money and of political influence, however recently acquired."

But all the blame is not on the *cacique.* It is doubtful if our form of government is best suited for a people not fully civilized. We were making progress when Mr. Harrison, Governor General from 1913 to 1921, allowed the executive power, which was his as Governor General, to be usurped by the legislative branch. The ruling class of Filipinos were thus for eight years in power. What they did with this power fills the largest part of the book.

One of the toys the ruling class enjoyed was the Philippine National Bank. To quote the author:

> Thus an institution whose assets has actually made it one of the biggest banks in the world showed, after five years operation by home talent, first, the loss of the entire capital stock, or $17,650,000, of which the Government owned $16,000,000; second, the loss of over half its total deposits; third, the tying up in frozen loans of all its assets over and above its losses; and, fourth, hopeless insolvency.
>
> In a word, having hugged their toy and kissed it and rocked it to sleep, the children had indeed banged it with a club, ripped it open and finally pulled the stuffing out.
>
> Their only embarrassment, indeed, had lain in the question of finding sufficient pretexts for laying hands upon the vaults.
>
> But, fertile ever in curious expedients, they had hit upon the plan of sending forth emissaries into highways and byways to drum up more borrowers.
>
> Said one of these who had penetrated to the manager of a business concern in a distant province:

"I represent the National Bank, and we wonder if you wouldn't like to borrow some money from us."

"I don't need anything," replied the manager, as one might speak to a wandering lightning-rod man or book agent.

"But listen—we could let you have 500,000 pesos just as well as not," urged the applicant.

Twenty million dollars were thus loaned by the bank to private individuals wherewith to do business on taxpayers' money in competition with men working on normal business lines and financing themselves.

And it is an interesting fact that $20,000,000 is, according to the figures of the American Chamber of Commerce, just about half the amount annually taken from the pockets of the people of the United States and presented as a free gift to the people of the Philippine Islands in the form of remission of customs dues on Philippine goods entering American markets.

The failure of the Filipino appears to lie in his character. To him liberty, self control, and honor are words with entirely different meaning from that given by an Anglo-Saxon—and we judge him by our own standards.

The charm of the book lies in the writer's way of letting her subjects tell the story. Frankly the book is as interesting as if it had a plot. Vivid pictures have been drawn,--told in the words of those who dwell in "The Isles of Fear."

The book is recommended to those who have been to the Philippines, to those who expect to visit the Philippines, and to the citizen who would know more about 10,000,000 people adopted, temporarily at least, by our country.—W. W. I.

How to Read History. By W. Watkin Davies, with a Special Section on American History by Prof. Edwin W. Pahlow. Geo. H. Doran Co., New York. 1924. 4¾"x 7". 259 pp. $1.25.

A study of such a book as this of Mr. Davies, stimulates one to read history, if merely to test his suggestions and the merit of his selections. It thus admirably accomplishes its purpose. The book may be likened to a handy review of historical literature: it certainly avoids being a mere catalogue of selected works. From a copious introduction giving an insight into the methods to be followed in study, Mr. Davies outlines general courses of reading or, rather, discusses groups of books on Ancient History, Classical Antiquity, The Middle Ages, The Renaissance and the Reformation, Reformation to Revolution, The French Revolution and Napoleon, and the Nineteenth Century, followed by a similar outline covering American History, written by Professor Edwin W. Pahlow. The recommended works have been carefully selected and from them one can form a well-balanced opinion of the affairs of the period studied.—C. D. Y. O.

Analytic Geometry and Calculus. By Crenshaw and Killebrew. P. Blakiston's Son & Co. 1925. 6½"x 9½". 222 pp. $2.75.

"Analytic Geometry and Calculus" by Crenshaw and Killebrew, professors at Alabama Polytechnic Institute, is written as a text for engineering students at that school, where the work in mathematics is given in two years, presumably the first two years of the course.

The book is elementary, but is clear and well supplied with examples, and should afford the average student a sufficient foundation in analytical geometry and differential and integral calculus to pursue his study of engineering subjects.

Chapter I would be best left out. It is called a review of algebra and trigonometry, but is exceedingly scanty, taking up only five pages of the book. The

student who has had algebra and trigonometry could and would refer to the text he studied; for the student who has not had these subjects, the chapter is altogether insufficient. There is no value in it as a reference.

The succeeding chapters take up briefly and in an elementary manner, but concisely and in a way probably best suited for the average college student: points and distances; the straight line; the circle; the equations of the conics in the simplest standard form; polar coordinates; transformation of coordinates; and conics with axes parallel to the coordinate axes (the last including a brief discussion of the general equation of the conic with axes parallel to the coordinate axes). No discussion of the general equation of the second degree is given, the only reference to the xy term being in a brief paragraph on rotation of rectangular axes. Polar coordinates are only touched on and the authors have purposely left out discussion of tangents and normals until after the methods of differential calculus are taken up.

The text on differential calculus commences in the usual way, the opening chapter on differentiation consisting of thirty-one pages. This is followed by a short chapter on the application of the derivative to mechanics. Following this, tangents and normals are taken up, then a brief chapter on some properties of the conics. This should be more complete or the chapter should be left out. The final chapters in differential calculus are on maxima and minima and on differentials.

There is nothing new in the presentation of integral calculus, the chapters in order being on formal integration, the definite integral, and applications of the integral calculus, mostly to problems of physics and mechanics.

The subjects of the final chapter on series are often taken up in algebra or in differential calculus. Tests for convergency are lightly touched on and the method of expansion by Maclaurin's Series is given. Computation of logarithms by the logarithmic series and the calculation of *pi* by Maclaurin's Series are taken up briefly.

A complete set of answers is given and the book should be useful within its province. The print is clear, the figures good, and the volume, in 222 pages including tables and an index, is of convenient form and size.—R. V. C.

Guide to London and the British Isles. By Alwyn Pryde. 1924. Forster Groom & Co., Ltd., London. 365 pp. Ill. Maps. 2*s*.

To one wholly unfamiliar with foreign travel this little paper-covered volume would be the perfect travelling companion; to one who has travelled it is a reminder of many things he enjoyed and many more things he had not known about but never would leave out of a second trip abroad.

Besides, being a complete guide as to one's itinerary, it contains delicate suggestions as to the attitude one should assume when visiting a country not one's own. With its quotations from British authors, its historical allusions, and its informative advertisements it might do away with the need of any other literature while crossing the ocean. Surely one could not require more of a mere guide book.—L. M. C.

THE COAST ARTILLERY JOURNAL

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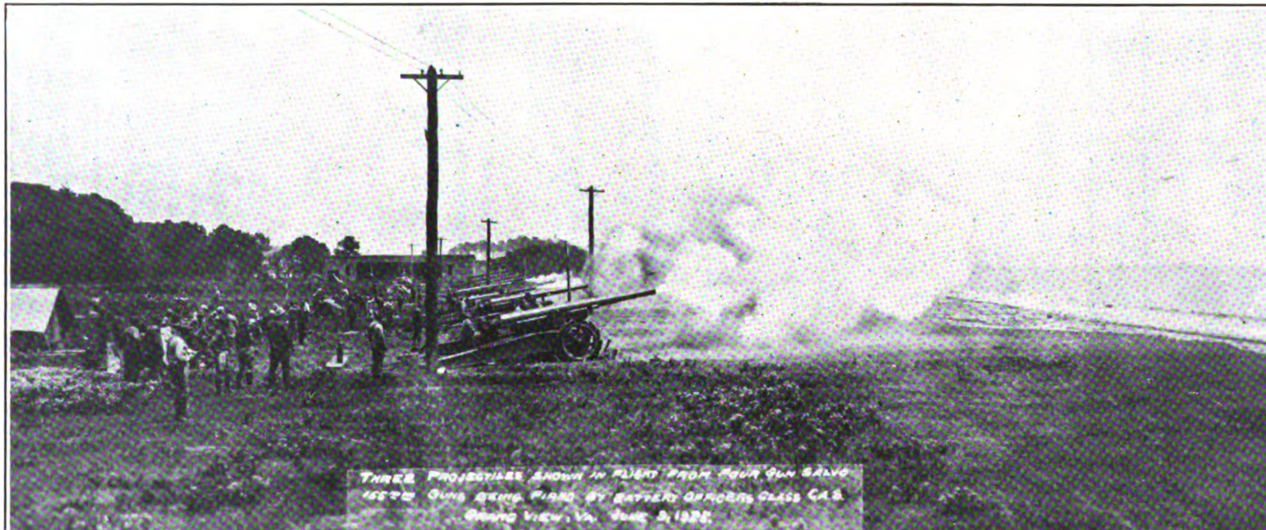

FIRST PRIZE, PHOTOGRAPHIC CONTEST

Submitted by Technical Sergeant J. C. Palmer, Fort Eustis, Virginia

THE COAST ARTILLERY JOURNAL

VOL. 63 DECEMBER, 1925 NO. 6

Providing for the Common Defense

MEETING AN OBLIGATION

THE Constitution of the United States gives as one of the reasons for the formation of our Government the providing for the common defense. Provision for the common defense cannot be accomplished in this day and age merely by accepting the doctrine as a good one, and then waiting for some one to attack us before we gather our hosts and the material for defending ourselves. Preparation for war in time of peace is necessary. President Coolidge so aptly advised in a recent important address that national defense requires more than merely talking about it, it requires that something be done about it.

The people of the United States, having decided that provision for national defense is a wise and sane proposition, leave to their representatives in Congress the extent to which their will shall be carried out. Congress appropriates the money wherewith we can maintain the necessary personnel and materials to safeguard our great, wealthy and prosperous nation.

There are many people in this country who do not desire any form of national insurance for guaranteeing the preservation of the liberties, rights and privileges which we now enjoy. It is seemingly preposterous, yet these peace-at-any-price, ultra-pacifistic sentimentalists, and the anarchistic and irresponsible elements are organized into societies for the purpose of spreading damnable doctrines to undermine our Government and to leave us unprepared to defend ourselves.

A large number of people propose that war be abolished. On the basis of their hope, forlorn as it is, they are willing to risk America's security by eliminating our armed forces. They are a set of harebrained theorists who are dangerous to the nation. The history of mankind, the generally unsettled condition in the world today, and the existence of major wars on several continents at the present time all should be convincing of the impracticability of that idea.

Reprinted from *Infantry Journal.*

Then there are a great number of people who see no reason for preparation until war becomes imminent. To them, military and naval establishments are too heavy a burden to bear in time of peace. They are the people who wish that war organization and materiel may be improvised hurriedly when it is needed. They favor cutting and reducing the Army and the Navy whenever some politician advocates it, with a selfish attitude that someone else in the future should bear their share of the expense.

The keenest people in this country for the avoidance of war are those who know war, who study its causes and effects and who have experienced its horrors and blighting influence. These are the people who realize the needs of preparation in time of peace; these are the people who know that military forces with proper equipment, capable of combatting a foe of modern times, do not spring forth without careful planning and training.

Material Needs for Defense

A *material* form of insurance against loss of life, liberty and our national existence is essential. In the National Defense Act of 1920 we have the plan for a structure which, if followed through, will afford adequate protection against any storm which may threaten the nation. The mere fact that the structure exists will do more to insure peace than can any substitute that has yet been offered from any source. This Act represents the combination of the best thought in Congress and the widest experience in the World War. It was a joint task. It has been tested from every angle. It has successfully resisted every attack upon its soundness of principle.

In the National Defense Act there is provision for an Army of the United States, which is made up of three components: the Regular Army, the National Guard and the Organized Reserves. Roughly these components are in the proportion of 1, 2 and 3 in numbers illustrating at once the dependence which is placed upon the citizen elements. It is truly an army of the people.

The National Defense Act is a beautiful plan, but it requires money to execute it. Congress, as we know, is harrassed from every side for more appropriations for this, that and the other activity. Every executive branch of the Government fights for its own needs and naturally believes them the most urgent of the moment. Political exigencies cannot be ignored. And so we find the Army of the United States holding its breath and wondering what its fate will be.

A rather curious situation exists as to appropriations for the support of the Federal Departments which must be kept in mind. Under our budget system, each department in the preparation of its

estimates each year for the coming fiscal year is given a limiting figure by the budget officer, representing the President, beyond which it cannot go. Regardless of the actual needs, the estimates must be cut and adjusted to meet this figure. These estimates are then presented to Congress in accordance with approved procedure and Congress can and does fall back upon the true statement and argument, "We gave you what you asked for."

The Regular Army

In order to fulfill its missions to the country, the Regular Army must not only have its various functioning parts organized systematically, economically and in correlation, but, in addition, it must be provided with financial means in sufficient quantity to enable these parts to operate efficiently along their respective lines of activity. Otherwise, the entire Army structure is doomed to failure, so far as it is concerned in making effective the only military policy the Government has ever had.

Based on the appropriations by Congress for the past few years, the Regular Army has been reduced in numbers in both officers and enlisted men; its organization and distribution have undergone considerable modification in order to enable it still to perform, in a restricted manner, the duties imposed by Congress and custom.

These duties may be stated, briefly, as follows:

1. To provide adequate personnel for the development and training of the National Guard and the Organized Reserves, and for furnishing a trained stiffening component for the organization of higher units for battle service, as well as to furnish the instructors for the Reserve Officers' Training Corps and the Civilian Military Training Camps.

2. To provide the necessary personnel for the overhead of the Army of the United States, wherein the duties are necessarily of a continuing nature.

3. To provide an adequate, organized, balanced and effective domestic force, which shall be available for emergencies within the continental limits of the United States, or elsewhere, and which will serve as model for the organization, discipline and training for the National Guard and the Organized Reserves.

4. To provide adequate peace garrisons for the coast defenses within the continental limits of the United States.

5. To provide adequate garrisons in peace and war for our overseas possessions.

The peace strength of the Regular Army, as fixed by the National Defense Act, as amended and approved June 4, 1920, for per-

forming the above missions was limited to 280,000 enlisted men, including Philippine Scouts. The Regular Army has been reduced from time to time by subsequent acts until it stands now at about 115,000 enlisted men, exclusive of Philippine Scouts. The effect of this succession of reductions has been to check materially the progress of Army reconstruction following the World War, and its application to its new functions in connection with the development of the National Guard and the Organized Reserves.

Repeated and careful studies by officers of the Army best qualified by experience and training to answer this question have shown that the present strength is inadequate, that in its attempt to fulfill its assigned missions with insufficient personnel, the Regular Army is slowly but unquestionably being wrecked.

In the gradual reductions of the Regular Army to its present size of 115,000, the following changes have been forced upon it:

1. Many units from practically every branch of the Army have been made inactive, that is, they have been cancelled from the active units.

2. The Regular Army personnel necessary for the development and training of the National Guard and Organized Reserves has been reduced to such an extent as seriously to jeopardize their value as ready and effective components in our military policy.

3. The overseas garrisons have been reduced to one-half the numbers believed necessary for their proper protection.

4. The activities as well as the output of our excellent military school system have been materially reduced.

In the entire United States Army there is now but one place where a combat element may be seen at normal fighting strength, and that is at Fort Benning, Georgia, where there is stationed for demonstration purposes in connection with the Infantry School a war-strength Infantry regiment, and that is even depleted by 4 of its 12 companies.

It is only here that the officers and noncommissioned officers who are fortunate enough to be asigned to duty as students from the Regular Army, the National Guard and the Organized Reserves, are privileged to see and train with companies and battalions of Infantry of the size and composition they would handle in time of war.

Ineffectiveness for Combat Service

One of the most important elements of the mobile forces of the national defense plan, the Air Service, is now in that critical stage of development in our country, when failure to progress will seriously, if not decisively, imperil the safety of the country.

In comparison with foreign nations, it is manifest that our Air Service, which has been reduced to 8,750 enlisted, has been placed under serious handicaps by the lack of personnel. It has been necessary to reduce the Air Service to a dangerously low point in the overseas possessions, to eliminate all Air Service units operating with the coast defenses to provide air observation for the Coast Artillery; to reduce the tactical combat units to only one of each kind, viz., one pursuit group, one bombardment group, one attack group; to curtail materially the personnel at all Air Service schools; and to cut the observation squadrons assigned to work with Infantry divisions to 55 per cent of active service requirements.

By the most economical distribution possible we have been forced, in the face of strenuous and persistent opposition on the part of the people locally, to reduce many of our coast defense stations to small caretaking detachments, relying on organized units of Coast Artillery National Guard to man the batteries in case of war.

To be effective, the Regular Army must be properly organized and must comprise all of the arms, including air service, and other special troops, necessary to constitute an efficient and balanced fighting force. To be quickly available for domestic use, this force must be suitably distributed to cover the three million square miles of the United States. Successive reductions in appropriations have forced reductions both in the numbers of important combat units, and in the strength of the remaining units to an extent that has resulted not only in an imperfectly balanced fighting force, but one below effective strength for any combat purpose.

Training Duties of Regular Army

The present restricted enlisted strength of the Regular Army not only prevents the organization of an effective combat force, but precludes the possibility of providing active units in sufficient peace strength to insure the complete practical training of the commissioned personnel.

It is generally recognized that the primary function of the Regular Army, as defined in the Act of June 4, 1920, is to lead in the development and training of the National Guard and Organized Reserves. Accordingly, it is all the more essential that the Regular Army endeavor to employ its organizations so that a sufficient number of units of all arms will be available to furnish an opportunity for the commissioned personnel to acquire the practical training with troops that will make it an expert personnel. Otherwise the

time would soon come when Regular officers will be only partly trained, and in consequence unacceptable as instructors and advisers for the civilian components.

Now what is wanted for the Regular Army? The War Department has asked repeatedly for a force of 13,000 officers and 150,000 enlisted men, and in addition the officers and men necessary for the increase of the Air Service. With this force—very small as compared to the armies of other great powers—the Regular Army will be enabled to furnish the necessary protection for the Panama Canal, Hawaii, Philippine Islands and other foreign possessions, to maintain three complete Infantry divisions and one complete Cavalry division within the continental limits of the United States, to provide sufficient personnel for the proper training and administration of the citizen components, and to be able to give a reasonable protection of our coast line.

The National Guard

The National Guard, too, has been having its troubles because of lack of appropriations. According to the program specified by Congress in the National Defense Act the strength of the National Guard should now be over 400,000. It is less than half of that, about 177,000.

Official requests have been made for a gradual increase of the National Guard, extending over a period of several years, for an ultimate objective of 250,000 men, but little heed was taken of them.

Reduced appropriations prevented the Federal recognition of many newly organized units, which meant that not only was the development of the National Guard stopped, but in addition a portion of the work already accomplished was undone.

The program for the National Guard consists of individual training during the armory period, supplemented with target practice where local facilities exist, in preparation for the field training period of fifteen days, during which target practice is to be completed and tactical problems for small units conducted. Reduced appropriations forced the National Guard to reduce its activities of training and hindered its development so that it will be handicapped when called upon to take its assigned place in the line of defense at the outbreak of war.

The Organized Reserves

The Organized Reserves consist of the Officers' Reserve Corps and the Enlisted Reserve Corps. The Reserve officers are our main dependence for building an army for a major effort in an emergency.

The requirement of Reserve officers totals approximately 150,000. There are now on the rolls about 91,000. This means nothing, though, unless these officers can be given some small amount of training to keep them in touch with their military duties. It has been conservatively estimated that the strength of the O. R. C. in peace time can be stabilized at 75,000 if the means of training and maintaining their interest can be provided. For the past two years the appropriations permitted of giving fifteen days' training to about 15,000 annually, but to keep the interest of these Reserve officers at least one-third of the total number should be afforded training annually, either in camps in summer, with Regular Army units during the year or in our service schools. If the funds were made available for payment of salaries, mileage and incidental expenses, with present facilities a larger number could be given this short training course annually.

As to the enlisted reservists, these will also naturally require some training. This feature is not yet developed, however. The enlisted reservists now number but 3,500. Eventually this force should reach 100,000. Its cost of maintenance will be nominal; its value to the country will be incalculable.

Appropriations adequate for training a lesser number of the Organized Reserves than provided for this year will not only arrest development but will imperil the entire Reserve project. As the officers with World War experience become nonavailable for actual service in an emergency by reason of physical defects, increased age or casualties, it becomes more necessary that provision for training of personnel be made. Within five years the casualties among World War veterans will make a serious impress on the character of the Reserve officer personnel, and therefore it is important that gradual progress should be made toward the objective. An appearance of nonsupport by the government, as evidenced by inadequate appropriations naturally brings discouragement to the Reserve personnel, which at the present time represents the flower of our manhood.

What is desired and needed for the Officers' Reserve Corps are sufficient funds to permit training for fifteen days each year, one-third of the officers therein; and for the Enlisted Reserve Corps, funds to permit the gradual development of this body to a force of 100,000 members.

The R. O. T. C. and the C. M. T. C.

As part of the National Defense project there is injected a method of replacing in the Organized Reserve those officers who

leave that body by deaths, resignations, and retirements. The plan is to train young men for these positions in the various schools of the country by imparting military instruction at the same time that they are acquiring their academic education. These bodies in the various so-called military schools constitute the Reserve Officers' Training Corps.

The government assists materially in this training process by making provision for equipment, clothing, and also pay for such boys while in the annual summer camps and by furnishing officers and noncommissioned officers of the Regular Army for duty as instructors. A graduate receives a Reserve commission and is normally assigned to a Reserve unit in his own locality. He becomes a part of the Army of the United States.

Lack of funds has prohibited the full development of this plan. Many schools are asking for this assistance and it cannot be given. Yet the life and effectiveness of our entire reserve system and citizen army depends on the R. O. T. C.

The present annual output is about 4,000 officers. Conservatively, 6,000 are needed to meet the yearly requirements.

The Civilian Military Training Camps have become a part of our military system. At these camps is imparted military instruction to the young men of the country who are not so fortunate as to receive this instruction while attending schools or colleges. These camps are extremely popular. They furnish a means for voluntary training in lieu of a system of universal training.

In another sense this plan involves physical betterment of the youth of our country. The experience of the World War proved to us that our population included a surprisingly great percentage of physical defectives. Many of these defectives were cases that could easily have been prevented or cured by a systematic plan for physical exercise and development. The present plan contemplates giving training to as many young men as possible and it is believed that their physical improvement will prove a great gain not only through the direct results, but indirectly as providing a stimulus to the general undertaking of physical training. The advantage to our population would alone seem to justify the expense of military training for young men.

In the summer of 1924 over 33,000, and in 1925, 35,000 young men at an average age of nineteen years, attended the camps. The number was limited only by the available appropriations. Applications for the camps the past summer reached over 50,000.

It is essential that this activity be allowed to take its natural growth until it reaches between 50,000 and 100,000 to be trained

each summer. These camps are now and should be perpetuated as a national institution of great value. They are the greatest schools in the country for the development of good citizenship and the manly virtues.

As a Business Proposition

In one sense this national defense plan is purely a business proposition. It is a national insurance policy in which by the judicious annual expenditure of a comparatively small sum the nation is guaranteed protection not only against heavy financial losses to itself and personal injuries and disabilities to its nationals, but it goes further and guarantees protection against death itself to thousands who otherwise would be called upon to make the supreme sacrifice. It is very cheap insurance. It carries an extremely low premium for the risks covered.

There is a point in all business enterprises below which maintenance personnel and maintenance costs can not fall without injury to the safety of the enterprise, a point which marks the dividing line between success and failure. Our experience of the past year indicates clearly that we have reached that point in our national defense enterprise. Twelve thousand commissioned officers of the Regular Army are not sufficient to perform the duties with which they are charged by law and custom. One hundred and twenty-five thousand enlisted men are not sufficient to fulfill the missions assigned the Regular Army.

The status of the components of the Army of the United States as to size, distribution and activities should, under no circumstances, be permitted to fall below the present level. More than that, the financial situation of the government makes it reasonable that we should revert to a steady and uniform plan of development of the defense project as contained in the National Defense Act.

It would, on the face of it, seem to be a wise measure of economy to spend a little more to get an adequate result rather than rest content with a result which is now shown to be clearly inadequate.

Satisfactory progress has generally been made in putting into effect the plans for developing the National Guard, and Organized Reserves, and for fostering the R. O. T. C. and C. M. T. C.; but it must be appreciated that the success of this policy is dependent upon the attitude of the public and the support that will be afforded by Congress. The untiring efforts of the limited number of officers of the Regular Army alone engaged in this work will not be sufficient to insure success. The World War veterans who are now

contributing the greatest influence will, in time, disappear and unless the public be brought to realize that military service is one of the obligations of citizenship, and that military organization and training, prior to the call to arms, are essential to national defense, we shall not succeed with the organization adopted.

The effects of the continually reduced appropriations upon the combat branches of the Army, based upon the experience of the past four years, threatens to wreck the entire scheme of national defense. Every enforced curtailment made in the plans for the development of the Army of the United States tends to tear down what has already been carefully built up at great expense of time and money and seriously imperils the whole structure of national defense upon which the Nation must depend for its continued existence.

One of our first duties is military training. The opportunity hereafter for the youth of the nation to receive instruction in the science of national defense should be universal. The great problem which our present experience has brought is the development of man power.—*President Coolidge, at Boston, November 2, 1918.*

Antiaircraft Firing

By 1st Lieut. C. E. Brand, *11th C. A.*

First Prize Target Practice Essay Competition

THIS target practice was of particular interest in that it was approached without that intuitive guidance which has apparently attended much of our antiaircraft development, but simply in the light of another artillery problem. The guns being fixed mounts and the officers coast artillerymen, the concrete foundation was accepted and built upon without a qualm.

The mission adopted was to train the battery to fire upon aerial targets with the same relative accuracy and rapidity that characterized our service of coast artillery proper.

We were equipped with the 3-inch antiaircraft gun, model of 1917, on the fixed mount. The range instruments included the standard altimeters, the antiaircraft telescope (wind computer), and the R. A. Corrector.

In the early stages of training it was observed that there were certain rather essential requisites not explicitly covered by the training pamphlets available. The range section needed, in the first place, a target to track in drill. The gun sections shared this need. The gun sections also needed fuses to cut in drill, the process of simulating the fuse cutting with a smooth pointed drill cartridge being painfully unlike the actual process of cutting a fuse.

This latter problem was attacked by having the ordnance machinist unload some service fuses and fit them on the points of the drill cartridges. These fuses could actually be cut to any desired setting. There was next discovered the utter futility of attempting to cut fuses for antiaircraft fire with the hand fuse setters with which the battery was equipped on account of the prohibitive amount of time required for one man to set the fuse setter and then cut the fuse for each shot. This was corrected by procuring bracket fuse setters, the hand fuse setters being temporarily mounted as such until the latter arrived. Fuse cutting and loading drill now went forward smoothly for about one day when

it was further discovered that the service fuses, which had been designed to be cut once or perhaps twice, would not stand the wear and tear of being cut repeatedly for hours of drill, the lugs becoming so badly bent and deformed after the first few hours that the fuses could not be properly cut. The ordnance machinist corrected this by equipping the drill fuses with larger (thicker), tougher lugs which would stand the stress of repeated use. Thereafter the fuse was always actually and accurately cut in drill, the setting being checked after each round had been unloaded.

Targets were provided for gun and range sections by constructing miniature aerial ranges. Some high trees and telephone poles in the vicinity of the battery supplied the chief requisites for these ranges, wires being strung from one to another of these, and the miniature targets, constructed to a scale relative to the distances used, made to ride on these wires on small pulleys, propelled by a stout cord passing over other pulleys at the ends of its course and wound on a windlass at the end from which operated. The difficulty encountered in the operation of these ranges was the matter of causing the target to move at a *uniform* speed. This was solved by using a windlass with a very small drum and a quite long handle. The operator could then by counting the quarter-turns of his handle at a slow monotonous rate move the target at a rate which would give fairly constant or constantly increasing or decreasing readings on the goniometers of the R. A. Corrector—approximately the usual fluctuations in the angular speed of a plane in flight.

The altimeters were set up at such a distance apart as to give convenient readings for drill—the correct distance relative to the scale of reduction of the entire range, as a fact. That is, if the actual altitude of the miniature target varied from 20 to 30 feet and it was desired to have this represent altitudes of from 2000 to 3000 yards it was necessary to set the baseline length on the B′ altimeter the actual baseline length *in feet*. (i. e. scale of reduction = 1 foot/100 yards). If it were desired that this same target represent altitudes of from 4000 to 6000 yards, the baseline length was set in half feet (i. e., scale of reduction = ½ foot/100 yards), and so on. The tracking of these targets provided drill in all essential respects identical with the tracking of an actual airplane. This drill had the advantage that the targets were always available and flew at whatever speed or variations in speed that might be desired.

At times gun drill was held for the benefit of the gun pointers and the traversing and elevating details in which a small bullseye target was suspended in place of the miniature airplane and actual firing conducted upon it with subcaliber ammunition (.30 caliber).

This proved to be of very great value in causing these numbers to acquire real facility in the operation of the guns.

Real he-men of around 200 pounds avoirdupois were selected as loaders; for this is a real man's job. This procedure had the disadvantage of being rather hard on the rims of the drill cartridges, but it gave the drill a snap like a whip and the sections an unbounded confidence in their ability to manipulate the guns.

While snap and precision characterized the gun section drill, smoothness and regularity were worked for in the range section. A sense of rhythm was developed in the fuse range reader in order that it might be imparted to the firing of the guns at the regular 4-second intervals, in this manner insuring that the same dead time was realized, as allowed for, on every shot. Since the goniometers click half-seconds this was readily done by requiring the fuse range reader to count to himself six clicks and send out his reading on the seventh and eighth clicks, thus (one, two, three, four, five, six)—*six—three;* (one, two, three, four, five, six)—*seven—flat;* (one, two, three, four, five, six)—*seven—one;* etc., the italicised numbers (which are the only ones he calls aloud) in each case being a fuse range in seconds and fifths *(6 3/5; 7; 7 1/5; etc).*

The smoothness and smartness of the drill were soon all that could be reasonably desired. It is really remarkable how quickly an antiaircraft battery may become trained to a creditably high state of proficiency. And the miniature range facilities of this battery, both for tracking and for subcaliber firing, and the actual fuse cutting practiced in daily drill added a great amount to the certainty of the state of training reached as well as to the speed and facility with which the training was acquired.

But the question now arose: how about the *accuracy?* That question is easily and positively answered in the Coast Artillery proper—*Records!* The same answer was naturally suggested in this case. "But —— blankety blank!", says someone, "Records are just what we want to get away from—and do some shooting!"

Bravely said! And after the shooting we might exclaim "So much fun! So much powder burned up!!—not to mention the noise!" Do we mean to imply that records are a *hindrance?*—a special kind of handicap which regulations have seen fit to impose upon us? No one who has ever trained a coast artillery battery to do really accurate work has any doubt whatever that it is through the records which form the basis of the daily analysis of drill that real accuracy is acquired—though the elimination of errors. And the records which a man keeps have the steadying effect of a flywheel on his functioning as a part of the battery machine.

It will not appear surprising, then, that a complete set of records was devised for this battery; to cover *everything*, so that the whole drill might later be checked through in detail, and to cause no delay whatever in the transmission and use of the firing data computed. For example, the B″ altimeter reader simply recorded each angle which he called off, as he called it. The B′ altimeter was furnished an extra recorder who recorded the angle repeated by the B′ reader to the B″ reader, the corresponding altitude which the B′ reader called off, and the angle indicated on the B′ plate at the instant the altitude was read. It was then possible, in analyzing the drill, to check the angle called off by B′ against the angle recorded by B″ as having been read by him; to set the B′ plate at an angle at which it had been set when the altitude was read, and then by carefully setting the pointer on the curve indicating the B″ angle, to check that altitude read upon the altitude scale. This was done immediately after the drill after verifying but not changing in any way the orientation of the B′ plate, including the base line setting. This analysis showed exactly the degree of accuracy which had been realized in the work of the altimeter sections in computing the altitude. Even the pointing of the observers' telescopes could be checked for consistency on the course of the miniature target by drawing it again along its course and pointing the telescopes carefully upon it at different positions.

The same thoroughness of check of the work of the R. A. Corrector was possible through the use of two extra recorders: one for the fuse ranges read and the altitudes set, the other for the settings of the dead time and complementary term cylinders and the correction settings on the goniometers. All other data on the R. A. Corrector could be recorded by its regular operators without interfering with their duties. The necessary records will be obvious to anyone familiar with this instrument, and will not be gone over in detail here.

Three recorders were required for each gun to check the data set on the gun and the fuse setter. A check sheet was drawn up containing all the data and upon which, at any time later, the individual records might be checked from one to another to show errors in transmission and net errors.

In the matter of synchronizing the several records there was necessarily some difference from the standard artillery usage because of the lack of T. I. bells. Fuse ranges were read regularly every four seconds. But other data were read only so often as there were changes, or at quite irregular intervals. The plan adopted was

to synchronize records by making a check mark, in a convenient column provided upon each record form, for each volley fired. By this means it was an easy matter to fit the records together.

In this connection it will be noted that volleys are not planned as such, but simply work out that way just as the bows of a symphony orchestra move in unison—i. e., through each being so meticulously correct. In order that a uniform dead time be observed it is necessary for the fuse to be cut and the gun fired immediately after each fuse range has been called off. The reading of the fuse range is then the "Ready,—Go!" signal for each gun to begin cutting fuse, loading, and firing. The process will be finished by well drilled sections in very approximately the same time so that a volley results. When the guns were not actually firing the checks were made on the records when "Fire!" was called out at the guns, which was done in a loud voice.

In connection with the drill on airplane targets, at a convenient time before any service firing was undertaken a plane from the local flying field was procured to fly altitude checking courses. A plane with an accurate barograph or altimeter, calibrated for the level of our base line, flew constant altitude courses, first at 3000 yards, then at 2000 yards, and finally at 1000 yards. Each course was tracked carefully and with complete records so that thereafter the baseline adjustment could be made to cause the computed altitudes to check with the actual altitudes at which the plane flew. For a baseline which is difficult to measure this is a very ready and effective means of determining it if a plane with an accurate barograph or altimeter is available. It is a check worth while for any baseline.

Firing a well trained battery is simply a repetition of the daily drill. This battery was no exception to that rule. The trial shot method of fire adjustment was used, a trajectory chart with a fine thread pivoted at its origin and a very direct and abbreviated variation of the prescribed form for the formal solution of the trial shot problem supplying the necessary corrections to be applied within some three to five minutes at most after the last shot was fired. The velocity and direction of the wind at several altitudes, including that of the trial shots, were taken by tracking bursts with the speed computer. In this manner the ballistic wind and trial shot data were computed within ten minutes immediately preceding the firing.

At the conclusion of this firing it was possible to say not only that so many hits per gun per minute were secured—a matter of chance in any case for a small number of rounds fired—but also that

no personnel errors were made, which is a matter of capital importance.

Some principal features of the training and firing of this battery:

Based upon Coast Artillery Experience;
Use of dummy fuses which could be set; drill in fuse cutting;
Miniature aerial range for drill;
Subcaliber aerial range;
Records, and analysis of drill;
Use of trajectory chart and abbreviated trial shot problem;
Use of speed computer and bursts to determine ballistic wind;
Altimetric check of baseline.

No nation, however desirous of peace, can hope to escape occasional collisions with other powers, and the soundest dictates of policy require that we should place ourselves in a position to assert our rights if a resort to force should ever become necessary. * * * We shall more certainly preserve peace when it is well understood that we are prepared for war.—*Andrew Jackson, Message to Congress, March 4, 1837.*

Notes on Public Speaking

By Lieut. Colonel W. H. Wilson, *C. A. C.*

PRIOR to the World War it was an accepted fact that the Army officer was not a public speaker. Many officers sought—and still seek—refuge behind this tradition. Since the war, this treasured myth has been examined, tested, found unfit for further service, and has been duly retired.

It is quite evident that a person trained to be a leader of men must have worth while knowledge on many subjects; it follows therefore that, knowing what to say, there remains but to learn how to say it to produce the real public speaker. The adjective "real" is used advisedly because it is desired to differentiate between the two men who can speak in public—the "real" speaker who says something and the wind-bag who succeeds in saying nothing.

Henry Howard Roberts, in his Public Speaker, says in part, "As a public speaker you should have perfect command of thought, of word, and of utterance; you must have ideas and emotions which you desire to express; you must have the power to choose the best words with which to clothe these ideas and emotions; and you must possess the ability to utter those words in the manner that will convey your ideas and emotions the most effectively to the minds of your hearers." Mr. Roberts might have added, "and then you sit down."

Mankind today, to a great extent, is civilized and lives in somewhat highly organized communities where the exchange of ideas is essential to progress and preservation. The human being possesses the powers of reason and speech, and upon the intelligent use of these priceless gifts depends the future of the race. It is our duty as members of these communities to be prepared to take up our share of the work, and to do this best we must be trained to express our thoughts and ideas clearly and logically whenever and wherever we may be called upon to do so—and sometimes when the invitation is lacking.

Thoughts and ideas, good and bad, come as the result of concentration and observation, assisted by the imagination. Concentration is necessary to secure coordinated ideas worthy of expression, and the keen observer with a fertile imagination is already well equipped for the mental struggle before him when he attempts or

undertakes to secure the ability to concentrate on the work in hand. A few men sometime fall short of success by permitting themselves to dwell too much upon non-essential details; thereby leaving the highway for the byway and becoming lost or at least delayed; they seldom reach a decision. The ability to concentrate and to observe may be acquired or improved to a remarkable degree by practice, and persons desiring to become public speakers should develop these qualities to the maximum. One does not always speak upon subjects of one's own choice, and therefore the ability to study and analyse an unknown or hitherto disagreeable subject depends largely upon one's power of concentration.

Mr. Roberts says in his book:

> Language is the medium by which thoughts and ideas are expressed. It is clear then that if you wish your ideas and thoughts to be expressed accurately and completely your language must be well chosen so that there can be no doubt in the minds of your hearers of what you really mean. You will not be slow to understand that your thoughts may be expressed grammatically and yet not completely or even accurately.

The power and use of words involve clearness, precision, propriety, brevity, simplicity, and euphony of expression. We frequently use words and synonyms without knowing their exact meanings; this is not good practice, and constant reference to a standard dictionary is necessary to enable us to employ not only such words as will express exactly what we intend but also in such manner that there will be no doubt that our hearers will grasp the meaning we wish to convey whether they will or not. This requires diligent practice to accomplish, but it is necessary if our efforts are to be crowned with success.

Clearness is essential to a proper and full understanding of what is intended, and obviously the selection of those words that will convey the thought in a precise and concise manner is the only way this may be accomplished. Words that are appropriate, simple, and short are to be preferred over those which are unusual or "flowery." The sentences, as finally written or spoken should be euphonious and free from tautology; and it requires great care to avoid the repetition of sound even when different words are used. Language that is suitable for one audience may be entirely out of place before another, even when the subject is the same; this teaches us to dress our thoughts in simple, plain, and yet forceful words that will insure understanding whatever might be the character of our hearers.

The vocabulary of the average man is limited and is usually influenced by his occupation and environment. We should enlarge and improve our command of language by intelligent reading, fre-

quent and regular recourse to a standard dictionary, and by conversation with prominent and recognized scholars in the community. The successful public speaker will not only have a good command of standard English but will, from time to time, enlarge his store of vocational and colloquial terms. An understanding of slang is desirable although its use by a public speaker is very infrequent and, like humor, dangerous except in small doses and upon those occasions recognizable only by the seasoned orator.

Ordinarily the subject of one's speech is of his own choice; but it sometimes happens that the subject of the talk is assigned. In the latter case, the topic may or may not be entirely acceptable to the speaker; it may be a new and unfamiliar subject or it may be one that is disagreeable or distasteful. In the last case a real effort is required to put the speaker in a proper mental attitude to enable him to prepare his speech—and to deliver it.

Regardless of the manner in which the topic of the speech was decided upon, the first problem confronting the speaker is his estimate of the situation. The factors entering into this study are the mission to be accomplished, the psychology of the situation, involving the best means of approaching the audience—whether by direct or indirect attack or appeal.

There are no rules to guide us in this first step; we must rely upon our judgment and common sense, and, in so doing, the average educated men can not go far astray. The decision made and the method of aproach or attack determined upon, the speaker is ready to undertake the preparation of his address. The mental processes of man differ widely, but, in general, it may be stated that the steps required at this time are: first, a full and careful analysis and study of the subject to resolve it into its principal parts; second, the collection and collation of all available pertinent data; third, the arrangement and study of these data; fourth, the rearrangement of all data to show facts and opinions in a logical manner; fifth, to proceed to the preparation of the manuscript or notes to secure clearness, force, and brevity; and finally,—a step sometimes omitted to the ultimate embarrassment of the speaker—the examination of the completed work in anticipation of possible questions and the preparation of answers or replies to the same. It should not be possible to heckle or confuse a speaker who has prepared *himself* in the manner outlined above.

Whether one writes out his speech in full or merely outlines it, remember that the application of the principles of logic are necessary to a thorough understanding and presentation of any subject. These principles enable us to analyze and study important facts and

opinions, to test their correctness, to discover their weaknesses, and to build up arguments that are not only sound, but so clearly stated that misunderstanding is eliminated or at least minimized. Errors in reasoning—fallacies—may occur at any step; we may misinterpret our perceptions or classify things wrongly or work out bad definitions or confuse ideas or draw invalid conclusions from premises. The risk of misjudgment is constantly present, and we must therefore be always on the alert. If one will study and prepare oneself to apply the elementary rules of the syllogism he should have little difficulty in building sound arguments or analysing those of others. These rules are very well set forth and explained on pages 117-126, of Mr. Robert's book, "The Public Speaker." Remember, however, that the syllogism is only a part of the process of reasoning. The impromptu speaker is as rare as he is envied, and often is not as extemporaneous as appears at first sight.

After-dinner speaking is different from the formal classification of oratory above considered, and, although susceptible to similar rules and treatment, it emphasizes the qualities of ingratiation and pleasing humor. The subjects on these occasions are of lighter vein because the guests desire amusement rather than knowledge or enlightment after a hearty meal. Careful and considerate study is therefore important.

Following the preparation of the address is its presentation. The usual sub-divisions are: First, appearance; second, utterance; third, delivery; and last, feeling. Appearance includes dress and mannerisms, and any exaggeration in either detracts from the speech—dress well but quietly and be natural in your pose and gestures. Good utterance requires diligent practice in articulation, enunciation, accentuation, and pronounciation. In the delivery, pitch, inflection and modulation of the voice should be accommodated to the size of the audience and to the acoustic conditions; do not speak too rapidly or too loudly—talk to the back row. With practice, your delivery will improve as you learn how and when to emphasize, to pause, and to gesture. Make your delivery without notes if possible, or if you must refer to notes do so quietly; never read a speech or repeat one from memory. Experience has taught us that to be effective the orator must be sincere, serious, and sympathetic; humor, as well as irony, has its place, but each should be used sparingly and in good taste, and not at all by the novice. Do not seek applause, nor let its absence annoy or distract you; it will come, if deserved, whether you will or not.

There are a number of errors and faults commonly associated with the young public speaker, and although it is not my intention

to point them out at this time, I must mention one which should be studiously avoided by all public speakers, and that is apologizing for one's speech. The audience will soon find out whether you can speak—there is no need to tell them—and it is indeed difficult to think of an occasion which would justify an apology on the part of the speaker.

Senator Beveridge, in his excellent little book entitled "The Art of Public Speaking," gives two summaries, both of which are apropos and well worthy of consideration.

(a) Matter:

Speak only when you have something to say.
Speak only what you believe to be true.
Prepare thoroughly; be clear; stick to your subject; be fair; be brief.

(b) Delivery:

Speak quietly and naturally.
Be serene and never pompous.
Enunciate distinctly.
Control emotion, never get excited.
Dress well, neither negligently nor with ostentation.
Suppress craving for applause; stop when you are through.

We are not a military nation. Our Army is so small as to present an almost absurd contrast to our size, and is properly treated as little more than a nucleus for organization in case of serious war. Yet we are a rich Nation, and undefended wealth invites aggression. — *Theodore Roosevelt, Message to Congress, April 4, 1908.*

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Nunquam bonos fortesq; milites habebis, nisi hac duo, velut instrumenta adhibeas, delectum & disciplinam.

LONDON,

Printed by *Iohn Dawson*, and are to be sold by *Francis Eglesfield* at the signe of the Marigold in *Pauls* Church-yard. 1639.

HOW TO PROVIDE IN PEACE FOR WARRE.

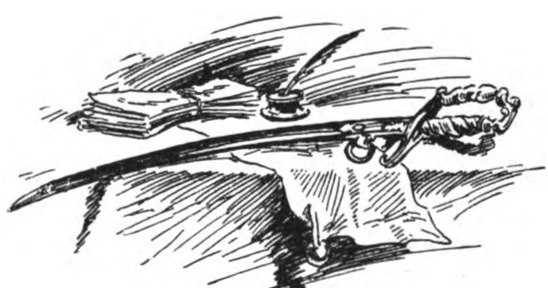
SECT. II.

CHAP. VI.

It is good in time of Peace, to provide for Warre.

HE that will goe to Sea, must before-hand provide himselfe of Bisket; and that Kingdome that cannot avoyd Warre, must before hand be provided of meanes to withstand it: for nothing can be more unseasonable, than to be about provision, at such time as we should be in action. A wise State (like HANIBALL*) will in prosperitie provide for adversitie, as well as in adversitie, hope for prosperitie; if they doe otherwise, peradventure they may have their heads broken, before they betake themselves to their bucklers: As may appeare, by the example of* KATHERINE *Queene of Navarre, and* JOHN *of Albert her Husband; whose want of timely preparation, gave occasion to* FERDINAND *the Catholike King, not only to invade their Kingdoms, but also after invasion, easily to subdue it. Had this Queene and her husband, beene in time provided,* FERDINAND *would eyther have desisted from enterprising any thing against them, or else he would have capitulated with them concerning a peace, in which they might have had the better conditions, being provided for warre: for the best treating for peace, is with the sword in hand. Or if he would have beene so hardy, as to have given them battell, they being provided, sure might have expected farre better successe than they found: but they were found unfurnished, and that was the losse of their Kingdome. And the same, may be the losse of any other. For how hard and difficult will it be, for any Nation, to resist an Enemie invading, if they prevent not his arrivall by their provisions. People are discouraged, by the suddainnesse of danger, and rather studie how by flight to shift for their particular safetie, than by making head, to preserve their Countrie from the Enemie.*

But, if any be so vertuously minded as to make resistance, how difficult will it be for them to draw together, in such a Kingdome as ours, where we have no fortified Townes, to hold the enemy play? The enemie shall no sooner heare of any assembly, but presently he will be upon them with his horse, to sever them before they can be able to make head against him: unlesse they will flye to the utmost limits of the Kingdome, there to make up an Army in haste; suffering in the meane time, the Enemie to enrich himselfe with the spoyle of the Country; and when such an Armie is composed, what good can be expected from it, seeing it must needs consist of raw, and untrained people, hastily gathered together, and altogether unskilfull in the use of Armes? When CÆSAR *came against* POMPEY *the Great into Italy,* POMPEY *and the Senate, being unable to make resistance for want of timely provision; they were glad to forsake, not onely the other parts of Italy, but Rome itselfe, and flye into Greece, before they could draw any competent numbers together, to give the Enemie Battell. Let* POMPEYS *carelesness be condemned, and let wise Estates imitate* AUGUSTUS CÆSAR; *who at the first brute of* ANTHONIES *stirring, provided himselfe, and crossed over from Brundusium, to give Warre the meeting; thinking it more safe so to doe, than to receive it within the limits and borders of his owne Italy: By these precedent relations, I hope any man may see;* THAT IT IS GOOD IN TIME OF PEACE, TO PROVIDE FOR WARRE.



Antiaircraft

By Maj. C. G. Mettler, *Ord. Dept.*

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SITTING here in the Ordnance Department, where we pass on guns and ammunition for both the aircraft and the antiaircraft forces, it is impossible to enter the literary arguments of the press concerning their effective power on one side without disregarding a pile of papers in the "In" basket which support the other. As we see our job, we must pass the most effective designs for procurement to each service and let them shoot it out for better, for worse. However, we have our own opinions on both sides and expect to express hereafter our desk opinion of the antiaircraft problem.

Let us look for a moment at this task form the standpoint of the hunter. What kind of a bird shall we load for? What dogs shall we take? So far as we have noted and so far as antiaircraft is concerned, this bird, the airman, is not flushed from a clump of bushes as we steal upon his cover, guided by sharp-nosed setters. He does not circle down to swim among a flock of decoys before our well camouflaged shooting box. He is rather an eagle or a hawk coming from a far off, protected nest, sailing high in the atmosphere, with a definite mission to destroy his enemies and sustain his friends. Can we here on the ground, protecting from his hungry talons the chickens we have raised with so much care through the damp spring days, divert him from his purpose? Can we make those pretty wings fail to suspend him in his chosen element and see him tumble end over end into the clover field, a sinister trophy to be hung aloft as a warning to his brethren? Again he is an owl flying high in the darkness, knowing from the reflected starlight in the streams and lakes how to find his way, and he swoops at the proper moment swiftly, surely down upon our guarded treasure, strikes and is away. Can we see him to aim our weapon, fire it to frighten or to destroy, or even blind him with our candle power? 'Tis true, he is still a noisy bird, telling the high heavens and all beneath that he is in the air, but he will learn to be more silent. And he is fast. Sometimes, three miles per minute, over two hundred and sixty feet per second, is his terrific speed. Sound travels only one thousand feet per second. If he be a mile away, five seconds must pass before we hear his humming

drone at any point. And when we hear it, he is not there, but a quarter mile ahead.

Even with our best guns and gunnery, he may make us stand armed at the hennery day and night by his very presence in the sky. He may hide behind clouds to await his chance, may even fly low across the fields behind the woodlands and hills, yet when his chance comes, when our eyes are weary, he may mount high and come upon an unobstructed, straight-line path direct to his destination.

ROCK ISLAND ARSENAL

Note the bridges, power dam, shops, and storehouses of an important Government plant which may require antiaircraft defense in time of war. The target is beautifully outlined by water, easy to identify, and readily put out of action by bombing

But even with his swiftness and cunning, if we merely stand on guard, however gun shy and fearful, we are to him a potential menace. If he comes at all before our scarecrow presence, he comes nervously, casting one eye in our direction and with his other getting one-eyed results from his journey. If we fight with vigor and confidence and scatter shell fragments and shrapnel balls about his rigging, his mind and hands forget their mission in the fear of annihilation and turn him upward and away.

Suppose we have only a little flock to care for, it may be concealed from his observation; but chickens, like soldiers, are very hard to keep under cover. And besides, the chicken stealer has other sources of information than his sight alone. He comes more often

with an exact knowledge of the location of our hennery, notes its condition and protection each time he passes overhead, and in his own time gets what he may from its contents.

On the other hand, confident of our marksmanship, we may expose our flock to tempt the flyer within our gun range, hiding ourselves and arms along his line of descent. With good fortune and enough trickery, we might some day nail his propellers on the hennery.

When one thinks of it broadly, there is a lot of individuality to such game hunting, just as we find individuality in the duck or partridge. I have seen many game birds fly directly behind a tree all the dangerous part of their escaping flight. I am sure they must have figured out this cunning safety code. Some have flown along a curved path until beyond my range, have dropped and risen, turned and twisted, changed their speeds. Just so, some aviators are born dodgers in the air, think quickly, dive for shrapnel bursts, turn and flatten off at the right time to avoid defeat and disaster. Others, less brilliant, come sailing directly, unhesitatingly into the field of fire and through it, often emerging, by reason of good fortune, not good judgment, without a scratch upon their fuselage. Really, it's a great game, if our heart's tenderness will permit us in these quiet hours of peace to think of it in such a light. When bombs fall on our churches, our factories and homes, killing our friends and kin, we shall have worse thoughts than these. It will be too late then to learn hawk hunting.

Let us drop the hunter for the moment and ride with the military aviators over the fields and cities of our enemy, over his marching armies and the trench lines of the battlefields on a trip of exploration to discover what he may find to attack. Perhaps here we may learn how we may defend our country and army against the hostile airman.

Below are machine shops turning out shell and shrapnel for the hostile guns. Beyond are magazines, indicated by spreading railroad tracks, storing his explosives and ammunition. There are his wharves, receiving from laden ships his overseas support. They are all fine targets for a bomb or two.

Turning to the open country, we see his supply trains running from the bases and depots to the railheads across viaducts and light bridges whose destruction would delay him many days along the battle line. Beyond the railheads are crawling solid lines of trucks onward to the distributing centers near the battle lines. Turning over a few trucks with a bomb on the highway would give him hours of trouble.

Back of the lines are bivouacked the tired troops recovering their strength and spirits for new efforts on the line. Our machine guns might strain their shattered nerves beyond the breaking point. On beyond there are marching columns of artillery and cavalry, whose horses might be frightened or destroyed with well-placed fire or some fragmentation bombs. On the lines are groups of men, hidden behind obstacles awaiting the signal to advance. Breaking their formation would delay their attack. Here are lines of men

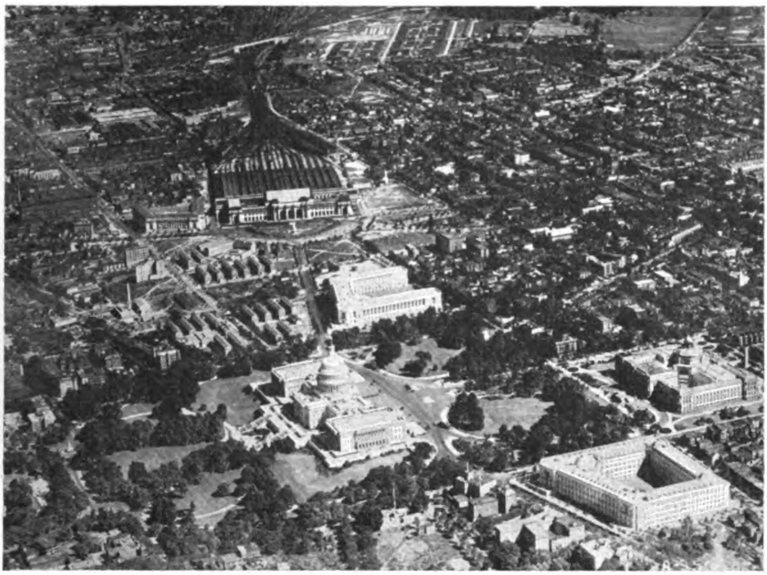
A familiar sight behind the firing line—easily and disastrously damageable by aircraft bombers

going forward to the attack, supported by the fire of their field batteries. How would their courage stand a swooping attack with our machine guns along their backs? How would their batteries sustain them with barrage if we attack their positions with bombs and gun fire? We find infantry, cavalry, and artillery on the march easy targets for machine-gun fire unless they are prepared to resist our attack.

Let us go home from this reconnaissance to think over the protection of our own ground troops from the attacks we might have made.

First and foremost, we must consider our own air forces. They must prevent the enemy from coming over, or, finding him already over, must drive him back or bring him down. That is the desirable

thing. But the air is so big. The radius of planes and ships is so large. No nation could build ships and train men to fill the air. Ships grouped for fighting must leave some places unprotected. Should we not concentrate our aircraft for attack instead of dividing it for defense over wide areas? If so, we must defend locally the individual units, the lines of communication, the dumps, railheads, storehouses, magazines, factories, wharves, and cities. This is the function of antiaircraft armament and troops. It has been done and it must be done again!



WASHINGTON, D. C.

Antiaircraft defense should be arranged for the adequate protection of the central offices of our Government

Perhaps the greatest and most effective defense ever carried out against aircraft was the defense of Paris during the World War, especially during the latter part of it in the summer of 1918. Some twenty to fifty miles away from Paris were located watchers who warned the central station of the approach of the enemy, and on beyond these were the firing lines who gave information of aircraft going over toward Paris. Around the outskirts of Paris, was located a network of guns which could cover almost all the sky area. On account of their considerable range, they were not so very close together after all. I am informed that there were two hundred and eight antiaircraft guns, handling the antiaircraft gun defense, and some one hundred and thirteen machine guns. Somewhere around

this network, and in advance of it, were located listening posts with large listening horns which would indicate the path and altitude of the approaching enemy, and also around this area were located some seventy searchlights which were directed by the listeners upon the part of the sky where the enemy was approaching. On the landing fields near Paris were located fifty-eight airplanes which could be sent into the air in ample time to meet the oncoming enemy and attempt to drive him away. In each center, arrangements were made to divide the fire of the antiaircraft battery so that each enemy

WILSON DAM, MUSCLE SHOALS, ALA.

Here stands a monument of construction which adds over 200,000 h. p. to the strength of the United States. It requires protection against aircraft bombing

plane was subjected to some sort of harassing attack. Around the city and beyond its limits were constructed various devices to fool the approaching enemy as to his objective. Lights were placed on spots which he might bomb without effect. Machines were set up to produce smoke clouds and alter the appearance of the city to prevent him from locating important areas. Balloons were sent up, between Paris and the enemy, with dangling cables into which he might fly and with machine guns to fire at him and telescopes to observe him. A central command was established which controlled all the defense within one well-protected room. From here the attack was directed and the population warned in the areas which were threatened.

Let us see what the effects of this preparation amounted to. The French reports indicate that some twelve Zeppelins in all attempted to make air raids on Paris on three different occasions. Of these, six were destroyed and only four succeeded in passing over the city. The Zeppelins were made a failure by the antiaircraft defense and practically no attempts were made after October, 1917.

In all, some five hundred planes attempted at different times to fly over the city of Paris, and, according to Paris reports, less than fifty succeeded in accomplishing their mission; that is, less than ten per cent.

Most of the attacks were made at night, especially in the latter part of the war, and at this time no airplanes were used to combat them. Some fifteen planes were brought down by the antiaircraft defense, and the German prisoners testified that many planes were hit, turned back, and regained their lines before coming down.

At one time, the Germans sent over by airplane twenty-two thousand kilograms of loaded bombs to be dropped on Paris. Only one thousand and sixty kilograms of them were dropped on the city and the destruction caused by these was repaired in a few days. Over twenty thousand kilograms were turned back and wasted. An aviator does not land with bombs on his plane. They are too sensitive to bumps. If he cannot drop them on his objective, he drops them somewhere else, no matter what effect they may produce at the place of dropping.

Several books have been written on antiaircraft defense. An excellent one has recently described the defense of London. One may readily compare this defense with that of Paris. The results were mediocre. Poor types of guns were assigned to this duty. Many of the troops conducting this work were rejected for field service. Yet the very presence of the armament and men in action served to turn back many riding planes, to break up formation, and to divert well-organized attacks from their objectives.

The strongest German antiaircraft defense was located around Leverkusen and Schlebusch, where the explosive and ammunition plants were located. No bombs were ever dropped in the vicinity of these plants, although attempts were made to bomb the bridges at Cologne nearby. The antiaircraft defense prevented any considerable damage. Here, one plane from the Allied Forces wound up a suspended cable in its propellers and fell at Diedenhofen in January, 1918. The Germans reported that they dropped seventeen Allied planes along the Somme and the Ayre with antiaircraft guns in one day, August 8, 1916.

In its protection of the troops at the front from observation, from attack by machine guns, and from bombing of their treasures of ammunition and supplies, antiaircraft defense often did remarkable work. In the early part of the war, the British found that they had brought down one plane for 8000 shots. At a later period they brought down one plane for 4550 shots, but in some areas toward the latter part of the war they accounted for a plane with every fifteen hundred shots. Firing at the rate of fifteen shots per minute with ten guns, this was ten minutes of fire per plane.

NEW YORK CITY

A pearl of great price—the business mecca of the world and an ideal target for the bomber

In our own service, five antiaircraft batteries which saw service at the front in France in 1918, fired 10,275 rounds at airplanes, and in these firings brought to the ground seventeen planes, an average per plane of 605 shots. Considering all the antiaircraft batteries in the United States Army area, the average per plane was about a thousand shots or six minutes of fire with ten guns. Two of our antiaircraft machine-gun battalions in 1918, from September until the Armistice, brought down forty-one planes with an average of 5500 shots per plane. At the present time, our gunners are hitting at the rate of one hit per hundred shots, but all hits do not drop a plane as indicated by recent tests at Aberdeen.

Aviators have inherited the knowledge of the antiaircraft defense on the ground, and, coupled with the antiaircraft defense in the air, there is quite a bit to worry about when the order arrives to go over and attack some well defended place.

Since the World War, a great many improvements have been made in aircraft. Greater speeds have been accomplished; greater bomb carrying capacity has been attained and even greater protection to the plane itself. The aviators themselves have learned much from the fighting in the World War, have gotten up schemes to maneuver and better aiming devices. They are handling themselves better in the air than they did before, and even know more about the problems of antiaircraft gunnery. They have learned more about the problem of attacking enemy planes; have learned to fly at night; have better methods of landing in the darkness; are perhaps better trained in finding their way about and know more about the indentification of objects which they are sent to locate. They have been furnished better cameras, better schemes for printing and reading photographs, and can make a map of an area from an almost invisible height.

In the meantime, the antiaircraft forces have not been asleep, although their advance has not been so marked nor so widely heralded. They have, however, been able to fire at longer ranges, to fire higher, to burst their fuses more accurately, to supply their projectiles with better tracers to indicate their trajectories in the air, to fire their guns more rapidly, to lead their target more quickly, to conceal themselves more securely, and, finally, to produce more effect with their bursting shell.

They have developed better listening devices to indicate the approach and path of the hostile airplane, to determine the altitude at which he is flying, to make more accurate corrections for wind, atmosphere and powder. They have learned visually to measure the rate of the airplane, both horizontally and vertically, and to plot where he will be when the projectile reaches that vicinity. They have learned more about airplanes and their flight, can identify types and predict their behavior; they know where an aviator must be in order to drop his bomb effectively on a known target, the direction he must take, and the altitude at which he can fly with the load which he is carrying. They are using the radio, the long range camera, the moving picture machine, and every modern improvement to enhance the value of their fire.

The Army has not yet covered the whole field of the work for antiaircraft. No definite decision has established just how our Infantry, Cavalry, Artillery, Engineer, and Supply columns will pro-

tect themselves on the march from aircraft attack. No field organizations have attempted—except in a few instances—to get a solution for their problem. The protection of important areas has not been solved beyond tentative plans based upon the defenses of Paris and London. We are still driving away at the fundamentals of the problem, whether the airplane can be hit and the aviator diverted from his mission by any armament and control instruments so far produced. We know part of the solution. We have data to make better guns, better mounts, better ammunition, better fire control.

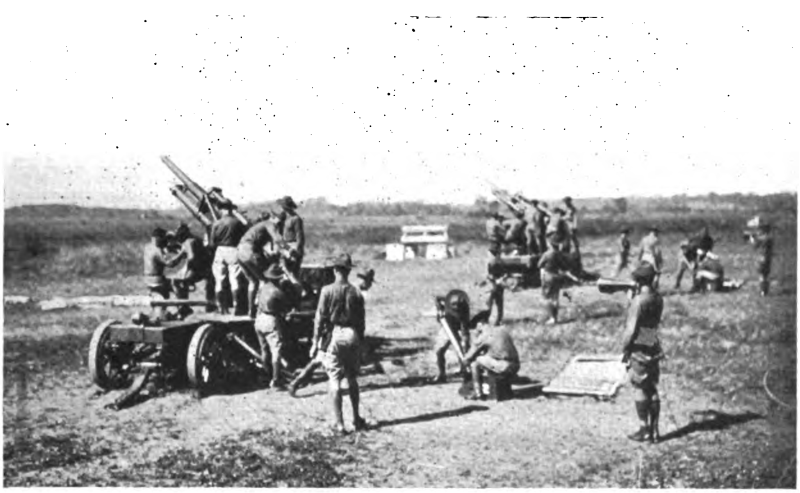
PARIS

The Etoile, center of Paris, from which aviators locate its important facilities. After all, little importance can be attached to the bombing done by the Germans due to the vigilance and effectiveness of antiaircraft defenses of Paris

A thorough plan for coordinating the various weapons, the locating and position finding instruments, and the transmission systems into one harmonious defense is demanded. Then what we need to know is the organization for using the armament and its accessories, the assignment of fighting units to a definite defense, the actual solution of that defense to indicate its deficiencies; and then to have a recheck of our developments to determine what else will be needed, in what quantities all the variety of equipment will be required, and the completion of plans for its procurement, issue, and maintenance. In order to work out these features, we need above all else the whole-

hearted, enthusiastic, mutual support of our antiaircraft forces and our Air Service. It is the problem of the Air Service to relieve itself from defensive work by the best development of antiaircraft and to find its greatest work in the mass attack of our enemies in the air and on the ground.

We are convinced of the necessity for antiaircraft and know many of its limitations. We know that it takes many rounds from any gun to score a hit upon an airplane. We know also that tons and tons of bombs from airplanes cannot win wars or entirely destroy our cities and homes. No one has ever determined the quantity of high explosive that was fired into Verdun, but it did not fall.



3-inch antiaircraft guns in action against aerial targets. They are not yet scoring quite so consistently as an expert wing shot but they are getting better and better. This sort of shooting requires the best firearm that can be made and no guessing

It is still there and still French. It takes thousands of rounds of ammunition to kill one man on the battlefield.

But with all the data we have, both aircraft and antiaircraft are still in infancy. Standardization has not set in. Their progress will not have reached the stage of quantity production for several years. Neither can clearly state its full war possibilities or war probabilities, and each will counter the other in war as armor and armament have done in the past.

Aircraft has the advantage of peace-time usefulness and has grown a little faster through commercial progress. Antiaircraft has no other peace-time usefulness than as a training tool for war. It has the disadvantage of depending upon its rival even for this

usefulness; that is, in the handling of its real target at which it may fire. Antiaircraft needs a maximum army effort to prepare itself adequately for its war-time task. It needs a large share of army money to develop suitable tools in adequate quantity.

Antiaircraft will never be one hundred per cent effective, nor will it ever be omnipresent to resist aircraft attack. But in its field, it has great value and must not be neglected. It is a function of our armies to learn what kind of armament can best perform the duties required, what instruments can best direct and discharge this armament, and what training must be done to use the armament and its directing instruments.

Human ingenuity is just as alert in defense as in offense. We can expect that no great invention for destroying life or property will come forth which will not quickly stimulate the people to provide a worthy device to counteract its effect.

There is a rank due to the United States among nations which will be withheld, if not absolutely lost, by the reputation of weakness. If we desire to avoid insult, we must be able to repel it; if we desire to secure peace, one of the most powerful instruments of our rising prosperity, it must be known that we are at all times ready for war.—*George Washington.*

The Past and Future of Defense Against Aircraft

By Captain Benjamin F. Harmon, C. A. C.

(Concluded from the November number)

THE one in one million hypothesis presupposes that the aviator will protect himself in all directions. In point of fact he will not change altitude greatly unless driven to it. He cannot climb very far in 20 seconds at high altitudes, and he is averse to losing altitude which is extremely valuable to him in case of attack or injury to his machine. Furthermore, if he is photographing the terrain or regulating artillery fire he must maintain a more or less even flight (in the first case exactly horizontal flight); thus the first fire-control assumption and the first principle of fire are evolved; namely, "Flight will be at constant altitude," and "The altitude is the most important element of the firing data." If it be assumed that his variations in altitude during the period of 20 seconds will not exceed 200 yards, then the mathematical probability of hitting becomes one in about one hundred thousand. This is still extremely high compared to actual results, and those results prove the correctness of the second fire-control assumption; namely, "Straight line flight." The instruments, then, are based on rectilinear flight. Those who have observed airplanes in flight know that such flight is not altogether in a straight line, but when an aviator is flying a mission in time of war, he must reach a certain point, fly over a certain area in a straight line for photographic purposes, or patrol back and forth over a given territory. The quickest and easiest flight for that aviator is in a straight line, and such flight will be changed generally when he reaches his objective, accomplishes his mission, arrives at the end of his patrol, or when he comes under fire. Therefore, the second principle of fire is stated: "Prepare the fire carefully—the first burst is the best" because when he comes under fire dodging is to be expected. It is noted here, however, that dodging in a formation is extremely limited unless that formation be broken up—an objective decidedly to the advantage of friendly planes. If aviators are compelled, by antiaircraft fire, to dodge actual and expected projectiles at all times, their efficiency will be greatly reduced; they will be unable to accomplish their missions.

Let us examine one method of making the prediction for rectilinear flight as developed during the the World War. Suppose a plane be approaching on a straight line toward the battery and at a constant altitude. At a given instant its angular elevation would be 800 mils and 20 seconds later this angle would be 900 mils; thus though his altitude be constant, there is a vertical deflection of 100 mils that must be allowed for, and in this case, with the plane flying toward the battery, no lateral deflection during the time of flight of the projectile. Should his flight be other than directly toward the battery both a lateral and a vertical deflection must be determined so that the future position of the target, that is, the point he will occupy assuming rectilinear flight, will be known.

Consider first a "double sight" so constructed that the two glasses turn together in azimuth (laterally) by means of a crank operated by one observer and vertically by means of a crank operated by another. If the two observers keep the cross-hairs of their telescopes on the target, the rate at which they must turn their operation cranks to do so will be proportional, evidently, to the rate of angular travel of the target, both vertically and laterally. To each crank is connected a small generator so that the r. p. m. imparted to these generators is similarly proportional to the rate of angular travel. Inasmuch as these generators have a constant field, the voltage output will also be directly proportional to this angular rate of travel, and voltmeters could be calibrated to read directly that rate in degrees per second, mils per second, or in whatever angular units were desired.

The desired result, however, is not mils per second but total mils deflection. If the rate of angular travel is ten mils per second and the time of flight twenty seconds, then the total travel of the target during that time of flight will be two hundred mils. This result is accomplished by inserting into the vertical and lateral circuits a resistance proportional to the time of flight, thus, in effect, multiplying the rate by the time, and reading from the calibrated voltmeters total mils deflection. It can be seen that the present azimuth plus the lateral deflection will determine the vertical plane in which the target will be and the present angular height plus the vertical deflection will determine a line in that plane along which it will be also. It remains only to apply the altitude, which has been determined and assumed constant, and the exact future point the target will occupy will be determined. All the necessary elements for firing can be obtained mechanically and electrically and the gun fired at that future point. In the instance under discussion the future or predicted

point would be a thousand yards from the actual position of the plane when the gun is fired.

The problem is by no means as simple as the preceding discussion would indicate. As described herein the present rate of angular travel was multiplied by the present time of flight. This process is correct only when the plane is flying in a circle about the gun as a center, in which case the rate of angular travel and time of flight are constant. Actually, the approximate deflection read from the voltmeters must be corrected for rectilinear flight by a separate instrument that solves mechanically the intricate formuæ for this correction.

Even artillerymen do not realize the difficulties of antiaircraft fire. The field artilleryman fires, observes the distance between shot and target, and corrects. To the antiaircraft artilleryman such correction is impossible. Neglect, for the moment, the fact that two or three batteries are firing at the same time, or that the target will change its course, and assume that one gun is firing at a plane moving in a straight line at right angles to the plane of fire. One shot is fired, and the battery commander waits to observe it. It bursts ten mils behind the target—should he increase his deflection by ten mils? To take one of many similar conditions showing why this correction cannot be sensibly applied, we shall assume that the shot was perfectly predicted. The projectile passes the plane at the predicted point but the fuse burns too long. The projectile and plane each continues on its way and the burst occurs *beyond* the plane. To the observer at the gun this burst beyond appears solely *behind* and the correction of ten mils would be valueless—in fact, it would be detrimental for it would prevent hitting by a fuse properly set.

The A. E. F. took its searchlight lessons from the British, its gunnery lessons from the French—but it showed them all what an effective weapon the machine gun could be. Two American machine-gun battalions, manning a total of ninety-six guns, had elements in line from August 1, 1918, to November 11, 1918, and were officially credited with forty-one hostile airplanes. Some fifteen hundred other machine guns distributed among artillery and infantry units are offically credited with two planes. The explanation of the contrasting results is specialization, training, and correct tactical distribution.

The destruction of hostile airplanes was the one mission of our antiaircraft machine gunners, and in this respect they were thoroughly and competently trained. Then they were placed where the low-flying planes were to be found—as close to the first line trenches as possible—and soon made for themselves this unsurpassed record.

The delivery of effective machine-gun fire against aerial targets with their high speed, while not as difficult as artillery fire, still calls for careful development and systematic training. It is by no means the simple problem of playing a stream of water from a hose. The range to the target must be estimated, the target correctly located in the sighting mechanism, and the results carefully watched. The A. E. F. principle of fire was "fire a short burst and correct," and the results they achieved would seem to favor that method over the method of long burst of "hose" firing. Note here that the machine gun or bullet is not heard by the aviator and therefore has no moral effect. It must hit and destroy to have any defensive power —and they did hit and destroy.

Not the least important phase in antiaircraft training, both guns and machine guns, is in identification of aircraft. A trained observer should be able to give the nationality and type of any plane by listening to its motor. This is a matter of concentration and study, and does not require a genius, as some believe. The identification is then verified by the physical characteristics of the plane or, in darkness, by a challenge from ground lights and a Very pistol reply of prearranged color from the plane. Any plane identified as hostile, any plane not identified as friendly (our Air Service must report in advance new type planes to be flown over the defenses), any plane not answering a challenge, or any plane adopting offensive tactics is engaged immediately. While the instances of the enemy flying captured planes are rare, that, and the appearance of unknown types of hostile planes, must be guarded against.

We have heretofore concerned ourselves with the past of antiaircraft defense. To the records of that past we point with a justifiable measure of pride. The enemy attacking planes were not invariably destroyed or even forbidden the zone of our troops, but, on the other hand, they were not permitted to operate with impunity. Between these two limits of perfect protection and absolute failure, the antiaircraft troops, operating against the most difficult target conceivable, overcame the almost insurmountable difficulties incident to the development of materiel and technique of fire against those targets and gave to their comrades in the Armies a measure of protection that reflects great credit on those responsible for the development and training. The defense of Paris by night stands as one of the remarkable achievements of the World War, and the firing of the antiaircraft machine gunners and artillerymen of the A. E. F. established for them an enviable and unequalled record.

What of the future? To sit by in smug complacence, satisfied to let the past be the future also, is inaction. "There is but one

ignominious thing in war and that is inaction." This quotation is equally applicable to the preparations we should make in time of peace for the war that may be thrust upon us against our national desires for peace.

One of the tremendous assets of our country is the inventive genius of its people. Many of those who have this creative attribute have interested themselves in military and naval requirements and not a few in antiaircraft questions in particular, attracted thereto, no doubt, by its difficulty and by the picturesqueness which surrounds combat between ground and air, serious though it be. Some of the solutions offered have failed because of their conflict with other military requisites, in other words, because of a lack of military knowledge by the inventor; but the records show innumerable valuable contributions to Military Art by non-military men. That the inventive genius of our people should be utilized to improve all conditions of our individual and national life is incontrovertible. It is equally apparent that by the excellence and power of our defensive means we guarantee the continued smooth national existence so desirable to our people—by preventing encroachment through the aggressive war of a stronger power. They should turn to military and naval problems also.

The creation of new passive means of defense is limited only by the practicability, efficacy, and relative cost thereof. An example of the development of new means of defense is contained in recently published news items which aver that it is now possible to interrupt an airplane ignition system by means of radio. Immediately thereafter follows the anticipated corollary that it is now possible to insulate the ignition system against radio interference. This radio attack strikes one by its tremendous possibilities, particularly those who have engaged hostile airplanes from the ground, if, indeed, it can be developed. This would be a humane defense when one considers that a dead engine does not by any means entail the destruction of plane and aviator, whereas artillery and machine-gun fire have that destructive intent and have no other *raison d'être.*

The desired improvements in our present artillery system of defense will be considered under the two heads of fire control and gun power. In some considerations the two are inseparable.

There are numerous objections to the systems of altitude determination that require a base line of three thousand yards or thereabouts, opposed to the single attribute of accuracy. Gunfire and accidental causes interrupt communications between the two ends of the base line and disrupt the determination of altitude. The observers at the two stations sight on different targets and thus

introduce inaccuracy. The time required for surveying the base line offers the principal objection when we are considering mobile forces. We are too prone to consider conditions of siege warfare as they existed in France as being determining, where time is not so vital a factor. On the contrary the antiaircraft guns must be prepared to function immediately for the protection of the mobile forces and they can go into action immediately and accurately only with a self-contained or short-base fire control system. The perfection of a coincidence on stereoscopic altimeter of requisite accuracy holds promise for a solution of this feature.

The prediction system must be compact, accurate, and rugged. However complicated the electrical or mechanical processes within the instrument, the manual operation must be easy, simple, and limited to not more than three men. In other words, the operations must be automatic and not require the setting of dials and indices by a number of operators, since the latter case introduces too great a probability of personnel error. The term "rugged" used in describing the necessary characteristics must be taken in a relative sense. The concussion of gunfire and jar of motor transportation must not impair the instrument, and naturally it must not be susceptible to breakage or derangement by its normal operation. The instrument will be operated not by scientists in a laboratory but by soldiers in the field.

Weight, *per se*, is not a limiting factor inasmuch as the instrument certainly would not weigh more than the guns it accompanies, but light weight is greatly to be desired.

Nor is there any prescribed method of prediction; naturally, the sole prerequisite is *results*. The method of prediction is interconnected with rate of fire, however. We may, for example, select a point in the sky which the target is approaching and measure back along the estimated course with great exactitude, and thus arrive at a set-back point a distance from the selected point equal to the plane's travel during the time of flight of the projectile. When the target arrives at the set-back point the gun is fired at the selected point. The fire thus controlled is intermittent and entirely too slow for engaging a target whose total exposure to fire is measured by minutes and seconds. The best solution will permit the rapidity with which the gun can be operated to be the limiting factor. Thus, if the limiting rate of fire of a 6-inch antiaircraft gun (assuming such an antiaircraft weapon to be a fact) is twenty seconds, the set-back method of prediction or intermittent fire prediction is entirely satisfactory for this gun if its predictions can be effected within that

limit of time. For the 3-inch gun with a rate of fire of four seconds satisfactory set-back prediction is not now conceivable.

If the horizontal projection of the aviator's path be tracked, rather than making a three-dimensional track of his actual course, it is probable that the machinery therefore would be less complicated. Having arrived at the predicted horizontal projection of the plane's position, an automatic table can be entered with horizontal range and altitude as arguments and all firing data to the gun determined.

There has been some consideration given the question of differentiating the plane's flight to the fourth differential. From a highly theoretical consideration this prediction is correct inasmuch as it enables any regular path to be predicted. Practically, it introduces undesirable complications that are not warranted by facts because there is only one regular path the aviator will maintain during the time of flight of the projectile, and that is the straight line. When he deviates from straight-line flight he does so for some vital reason. and if that impelling reason be our fire his resultant path will be indeterminate. Our best hope, then, for a hit is by the rapidity and dispersion of our fire. Note, however, that if we force such irregular flight on him we have imposed our will on him and taken from him the ability to perform his mission during his dodging flight. Note further that while irregular flight is possible in formation flying the magnitude and time of deviations is extremely limited unless the formation breaks up—which is the result desired from our viewpoint. Generally the second differential of flight is the limit of utility and practicability.

We are more and more inclined to the theory of indirect fire, that is, fire in which the guns are "blind." The computing instrument determines an angular direction (azimuth), an angular elevation, and a range. These three values permit the operation of the gun without sights.

The probability of hitting an airplane varies with the time it requires to deliver a predicted shot or, more properly speaking, with the cube or higher power of that time. There is only one way we can control the enemy's will and that is to culminate our action in less time than his will and the abilities of his plane enable him to change his flight. The time concerned is divided into two parts: the first, the time of flight of the projectile which fire control cannot alter; and the other, the service time or dead time of the piece. During this dead time the range must be transmitted to the ammunition detail, the fuse set at that range, the gun loaded and fired. In practice it is considered as being eight seconds. For an average firing

condition where the time of flight is sixteen seconds this dead time is one-third of the total time between prediction of range and burst of projectile. If our estimation at the beginning of this paragraph is correct, the elimination of dead time would result in twenty-seven times the present probability of securing a hit. Manifestly, even though the estimated ratio be not exact, the elimination of dead time is a vital step in securing more effective fire.

Elimination of the dead time may be accomplished in two ways. In the first place, the time fuse may be eliminated and a super-sensitive fuse substituted that will detonate upon contact with any part of the plane. The chance of obtaining the direct hit necessary to detonate such a projectile is so small compared to the chance of a hit by shell fragments as to eliminate this consideration in guns of 3-inch or higher caliber. For a solution of the difficulty it seems necessary to set the fuse while the projectile is being loaded or after it is in the gun. A mechanism to accomplish this is difficult to imagine, but there are very few things impossible in this world.

The fuses which we use at present are operated by varying the length of a powder train which is fired by the inertia of a plunger when the gun is discharged. The time of burning of this train is not a direct function of its length when the projectile passes through the varying atmospheric conditions between ground and airplane, with resultant changes in rate of burning of the train composition. This introduces undesirable complications in the fire control system which would be eliminated by a fuse whose time ratio would be unaffected by variations in atmospheric conditions. Clock and watch manufacturers are now attempting the design of a clock-work fuse that would function under the high rotative speed of modern projectiles.

It is in gun power that the most valuable improvements may be made. Gun power is not measured by the caliber of the gun; in fact, the caliber of the gun is limited by factors of mobility, expense, utility, and power per minute. The mobility and expense factors are readily comprehended. It is futile to spend the money for a 12-inch gun where one less expensive would suffice, and more futile to consider a 12-inch gun in connection with the mobility required by antiaircraft tactics. In point of utility we have about reached our limit in a 4.7-inch gun which has a range equal to the maximum range at which airplanes will ordinarily be visible. Any additional range would be of no value and the guns consequently inefficient. In point of power per minute the 3-inch gun would probably be equal to the 12-inch gun, if such an antiaircraft weapon be imagined, since the high rate of fire of the former will more than compensate for the

larger destructive radius of the latter. Bear in mind that penetrating qualities are not necessary beyond those obtainable in a small-caliber gun. We are not firing against twelve inches of Krupp armor. To reverse the old saying,—"Never send a man out to do a boy's work." If we balance carefully the factors gun power per minute, maximum desirable range, mobility, expense, maneuverability, ammunition space, and weight, we shall arrive at the conclusion that the ideal antiaircraft caliber is about 4 to 5 inches. The recognized 4.7-inch caliber in our service seems to meet all requirements.

Having accepted the caliber, the power of that caliber may be increased by an increase in the muzzle velocity or in the destructive radius of burst of the projectile. We cannot reasonably expect a very great increase in the latter case, but to the former we look for the final solution of the artillery problem. The Utopian gun for this type of fire is one in which we may fire point blank and thus culminate our action before the will of the aviator can take him from the burst of the projectile. To do this the muzzle velocity must be practically infinite so that the time of flight would be very nearly zero (actually about one-half second). Manifestly this limit can never be reached but it can be approached. We hope for an antiaircraft gun of almost twice the present muzzle velocity (2600 f. s.). Muzzle velocieties of around 4000 foot seconds are not unheard of or difficult of attainment; but bear in mind that there must be a permanency to our defense. We cannot guarantee such permanency should our guns wear out in a half day's fire, which eventually would be true as high velocity guns (4000 f. s.) are now constructed. Some students of this undoubtedly difficult question anticipate that the smooth bore gun will come into its own and solve the antiaircraft difficulty. When a projectile has been designed that will "feather" or hold a true course when fired from a smooth bore gun we shall be approaching that Utopian gun previously mentioned.

The gun has always been considered the backbone of the defense because of the great altitudes at which planes usually flew—altitudes unattainable to a machine gun. More consideration is given the artillery technique than the machine gun because of the greater difficultiles in, and importance of, the delivering of accurate fire therefrom. In no event should the extreme importance and efficacy of the machine gun be overlooked in our interest to solve the more difficult problem. When the attacking plane comes within machine-gun range the artillery is more or less unable to engage it because of the difficulty of maneuvering a gun at the great angular speed then necessary. The machine gun is fully capable of bearing this burden unaided.

It is highly probable that the Air Service tactics of the future will be more bold than in the past; in fact, the development of the armored attack plane proves the contention. Swarms of attack planes will engage infantry and artillery; and aerial activity within machine gun range will be intensified. The importance of the machine gun has increased in proportion.

The .30-caliber machine gun did its work efficiently. It has been stated that the French developed the artillery, the British the searchlight, but that the Americans achieved the highest results with the machine gun. In view of the advent of armor on planes and in consideration of the necessity of increasing machine-gun radius of activity, the .50-caliber machine gun has been developed and is an assured success. The 37-mm. automatic gun promises to be. One need have no fear of the results here. The aviator who comes within range of a well-trained battery of these super-machine guns is in for a long, hard winter.

Antiaircraft searchlight requirements differ from ordinary searchlight requirements principally by virtue of the mobility required (hence, light weight), the requisite rapidity of maneuvering, and the necessity for 90° elevation. The open type or "dishpan" light more than satisfied the requirements of mobility through its light weight; but the attendant decrease in illuminating ability has turned searchlight engineers toward the barrel type light once more. The design of such a type within the weight requirements of mobility will be perfected shortly; in fact, it seems assured now.

A plane is seen or it is not seen in the searchlight beam, according to whether the contrast between its brightness and that of the beam through which we look is sufficient. When standing at the searchlight looking toward the end of the beam we look through its entire length, and it has, to us, a maximum brightness. There is not sufficient contrast between this brightness and that of a plane in the beam (unless it be very close indeed) to enable that plane to be seen. As we move off to the flank of the light, the length of beam through which we look, and hence the brightness, becomes less and we are able to see the plane farther away. Present pipe searchlight controls enable the operator to be twelve feet from the beam—in some cases less. This is not sufficient. Maximum visibility conditions consistent with other concurrent requisites will be reached about one hundred to three hundred feet from the beam. Here we must station the observer and he must operate the light by remote control. The design of a remote control system which will be light, rugged, and permit the rapid maneuvering of the light necessary to following a target traveling at high speed offers an interesting problem for solution.

The searchlight beam is a minute pencil of light in comparison to the immensity of the volume to be searched. That volume is considerably decreased by locating the plane from its sound by the unaided ear; but the unaided ear is not sufficient. In the general discussion of the method of "fire by sound" herein, mention has been made of various apparatus designed to locate an aerial source of sound. In none of these has a satisfactory solution been attained. A sound location system must be perfected whereby—

(a) The azimuth and elevation of the source of sound may be determined instantaneously and continuously.

(b) The location should be positive—not requiring an oscillation of the apparatus either side of the normal to the source of sound.

(c) The system must be selective. The operation thereof must not be interfered with by gun fire, terrestrial sounds, or airplane motors other than the one being tracked.

(d) The method of determination should be preferably ocular rather than auricular, that is, the sound waves should be transformed to some form of energy (for example, electrical energy), that is easily measurable. The results will then be visible and will not depend upon the uncertain ability of the human ear to sense an exact maximum or an exact phase.

(e) Naturally the system should correct quickly for lag and refraction of sound.

(f) While mobility is a prerequisite for the antiaircraft troops protecting the combat armies in the field, the defense of cities and fixed utilities requires no ability to move from point to point rapidly. It is in this type of defense that the sound apparatus becomes of such vital importance. Therefore, while a field apparatus (mobile) would be required for mobile troops, lack of mobility and necessity for more-or-less laboratory methods would not necessarily bar a system for use in defending our fixed sensitive areas.

The perfection of the sound-locating system along the preceding lines will permit the immediate illumination of hostile planes within visual range. At the same time it will enable the gunners to overcome in a large measure the difficulties incident to darkness, fog, mist, and clouds in repelling attackers by the method of fire by sound.

Results have been achieved by antiaircraft troops that are unbelievable when compared to the mathematical probability that an airplane will not be destroyed. Even so, such results are not sufficient. With those results in mind we have heretofore said to the Air Service: "Your pursuit planes are the best defense against hostile planes by day. We will support you at all times and act alone in

your absence." In the future, as development progresses, we intend to substitute for that statement of cooperation another: "Yours is an offensive arm and should be conserved for offensive roles. We are now prepared to assume the entire defensive burden within our territory that you may devote all your power, personnel, and materiel to offense, which is the essence of victory." The time when that statement may be made with confidence is coming surely and is coming quickly. Antiaircraft defense is now an essential in warfare, and its value will increase as through study, invention, and training its destructive power is augmented until it stands to aircraft in the relation that seacoast guns now have to vessels of war—absolutely debarring them from the areas protected.

Nothing can be more inconsistent with true public economy than withholding the means necessary to accomplish the objects entrusted by the Constitution to the National Legislature. One of these objects which is of paramount importance, is declared by our fundamental law to be the provision for "common defense."—*Chester A. Arthur, Message to Congress, December 6, 1881.*

Annual Report of Chief of Coast Artillery

Extracts from the Annual Report of the Chief of Coast Artillery, (Major General F. W. Coe) to the Secretary of War Fiscal Year Ending June 30, 1925

DURING the past year the efforts of this branch have been directed towards: The maintenance of the foreign garrisons; The training of the officer personnel in the United States to insure the maximum professional advancement; The instruction of the National Guard and the Organized Reserves; The training of prospective Reserve Officers in the R. O. T. C. Units and in the C. M. T. Camps; The development of materiel and of training methods; The preservation of materiel and protection of property at stations not fully garrisoned; The distribution of the personnel and the training methods followed to accomplish the above are set forth in the succeeding paragraphs.

As an incident to the above activities, there has been maintained a limited power for meeting an attack directed against our coasts.

It cannot be assumed, however, that an effective defense could be made of our important harbors and naval bases with a Regular Army enlisted strength of approximately 3400 and a National Guard strength of approximately 7300 when there would be required 46,730 enlisted men for a complete manning of the fixed armament in war. The Regular Army and National Guard strength assigned to railway, tractor and antiaircraft artillery is fully as far below a reasonable minimum.

Since 1913 the term "Coast Defense" has been used to designate a command of one or more forts provided for the defense of a harbor or point of the coast. The use of this term was based upon the theory that an adequate defense of the coast as a whole was assured by the defense of important seaports and naval bases.

The World War has modified this conception and an adequate defense now contemplates denying an enemy access to any landing place where he could quickly establish himself in force.

In consequence, it has become increasingly difficult to restrict the use of the term "Coast Defense" to the narrow limits indicated above, since it so adequately expresses the broader mission.

The term "Harbor Defense" has therefore been substituted for "Coast Defense" without change in the organization of the commands to which applied. * * *

Under the provisions of A. R. 265-10 representatives of this office have made training inspections of all the regular regiments of Coast Artillery located in the continental limits of the United States. These inspections have indicated that training programs now in effect are too crowded and that, in consequence of this, regimental commanders are finding it difficult to maintain a high state of morale in their commands.

Reports of target practice show improvement in fire against simulated naval targets during the year. There has been an increase in the number of hits per gun per minute, and in the firing ranges, and a decrease in the times of making adjustments from observation of fire by battery commanders.

During one target practice in each Coast Artillery district battery personnel has been subjected to a gas attack. These firings have emphasized the need for gas masks suitable for the personnel operating telephone and optical instruments. This has been brought to the attention of the War Department and the development of a suitable mask is in progress.

Under War Department instructions of April 18, 1925, exhaustive antiaircraft service training is now being conducted by the 62d Coast Artillery (A. A.) at Fort Tilden, New York, in conjunction with the Air Service personnel located at Mitchel Field, L. I., with a view to determining the degree of efficiency which may be expected from antiaircraft gun and machine-gun fire against air targets and the ability of searchlights, directed on data furnished by listening devices to place their beams upon aircraft and to illuminate continuously a target while it remains within range.

These firings as well as those held during the year by other Coast Artillery antiaircraft regiments have demonstrated that this form of fire is more effective upon bombing planes than that of other classes of artillery against their normal targets. * * *

Coast Artillery Organized Reserve Training: The predominant features of the training of Organized Reserves during this year have been the training of organizations as units, the more intimate supervision over active and inactive training by unit executives, the increased interest taken in the Army Correspondence Courses, the inauguration of periodical conferences on artillery subjects in certain centers containing a number of Coast Artillery officers, and the training of officers for wartime duty in this office and at the Coast Artillery School.

Up to this time it has not been possible to train properly in antiaircraft methods the personnel of the seventeen antiaircraft artillery regiments located in the central part of the United States, owing to there being no regular Coast Artillery antiaircraft regiment to form a training center for these units of the Organized Reserves. Funds have been available to send only a few of the officers of these regiments to any of the three regular antiaircraft regiments located on the seacoast. Arrangements have been made to train this personnel with National Guard Antiaircraft regiments at Fort Sill, Oklahoma, and Camp Sparta, Wisconsin. To assist in this training, regular Coast Artillery teams have been sent from the nearest antiaircraft regiments. This arrangement is not satisfactory, and proper training can be given to these units and the three National Guard regiments similarly situated only by organizing and stationing a regular antiaircraft regiment at some point in that region.* * *

In my last annual report attention was called to the fact that a definite advance had been made toward providing adequate fire control systems for the long-range guns already installed through the approval by the War Department of a project for the completion of these systems within a certain number of years. The results expected have not materialized. The fire control projects for the United States were approved for completion on an eight-year basis. The appropriation made available for this purpose for the fiscal year 1926 will, if continued, provide for completion of these projects in not less than thirty-five years. * * *

The .50-caliber machine gun has been adopted as the standard machine gun for antiaircraft defense. A new tripod has recently been developed for this gun which gives increased stability in firing. An experimental sight has been designed, manufactured and issued for service test that is expected to give good results. As soon as funds can be made available, .50-caliber machine guns should be supplied to all Coast Artillery units for antiaircraft defense in replacement of the .30-caliber machine guns and automatic rifles still in service.

The new 3-inch antiaircraft gun, Model 1923-E, on mobile trailer mount, is now undergoing test at Fort Monroe, Virginia, and preliminary reports indicate that both gun and carriage will be satisfactory as soon as minor defects have been corrected. This gun embodies many improvements and, when it is finally approved for manufacture, immediate steps should be taken to provide for the replacement of the 3-inch antiaircraft gun, Model 1918, on auto trailer mount now being used by our antiaircraft organizations.* * *

The urgent need for sound locating devices for detecting and tracking airplanes at night with a view to their illumination by searchlights has been met by the design, manufacture and issue by the Ordnance Department of experimental instruments. This development work is considered of great importance and will be pushed to completion as rapidly as funds permit.

The open type 60-inch searchlight was a wartime development and is not entirely satisfactory. A redesign has been completed. The new type is an inclosed light of greater power without increase of weight. Nine of these new lights, with improved control apparatus, have been ordered and are under manufacture. * * *

In addition to my suggestions made throughout this report and to my recommendations of former years, referred to in the second paragraph above, I wish especially to urge at this time the necessity for increased activity in the development of our antiaircraft service.

Other Coast Artillery developments are either reinforcements or extensions of well-tried-out ideas.

The antiaircraft service is, however, at a point where original investigations and extended trials of new designs and methods are imperative.

Every assistance should, therefore, be given this new service both by supplying the organizations assigned thereto with the latest developed equipment and by affording them the maximum opportunity for perfecting themselves in its use.

It is only in this way that a true estimate may be had of the value of a service which bears such an important relation to the national defense.

The battle is not to the strong alone; it is to the vigilant, the active, the brave. — *Patrick Henry, in the Virginia Convention, March 20, 1775.*

EDITORIALS

Economy

WHAT is economy? In its application to military affairs, the United States has not always been able correctly to answer the question; and at the moment of writing there appears again a tendency to choose the wrong answer.

The Army of today is the product of a gradual process of evolution. It started from nothing. Its origin was largely influenced by the old Anglo-Saxon prejudice against standing armies as dangerous to our liberties,—a prejudice which is still with us and which has had much to do with shaping the course and controlling the destinies of the Army. Our Army has therefore always been built to suit the needs of the immediate present. Consequently its career is represented by alternating periods of expansion and contraction—rapid expansion upon the outbreak of war and almost equally sudden contraction upon the conclusion thereof.

As a result, our national existence has ever depended primarily upon the untrained citizenry of the country,—a body which has on many occasions rendered valuable service after training, but which has never proven its worth for general military purposes while still untrained. This lack of suitable, economical preparation, this use of untrained troops has prolonged all our wars and has rendered them appallingly and unnecessarily costly, both in lives and money.

Our histories do not bring this to our attention. Our histories record only our triumphs and lead us to the logical conclusion that we can dispense with a regular army. Our histories seize upon the Battle of Bunker Hill as an example of the use of untrained troops and neglect to note that the troops fought not only behind breastworks but also under trained officers, veterans of the French and Indian Wars.

In the Revolutionary War, by enrolling 396,000 men, by allowing seven years of time, and with the assistance of a foreign ally, we defeated an enemy whose numbers never exceeded 42,000. In the War of 1812, we enrolled 528,000 men to defeat an enemy who never numbered more than 16,000 or 17,000; and we suffered the humiliation of Hull's failure at Detroit, Hopkin's fruitless expedition, Harrison's experience, the failure of the militia under Solomon Van Renssalaer, and the abandonment of the National Capital to the enemy after a loss of eight killed and eleven wounded. In the seven

years of the Florida War we enlisted 41,000 men with whom to combat five or six thousand Indians, and then we failed to effect the forcible emigration of the Indians which was the sole cause of the war.

The Mexican War was fought with trained and disciplined troops, but it was lengthened that troops might be trained and disciplined. In the Civil War untrained army met untrained army. In 1898 an unprepared army met greater incompetence. In the World War we required a year before we could put trained troops in the field.

The obvious solution is to provide trained men, and this is the purpose of the National Defense Act. But the National Defense Act becomes inoperative when neither trained instructors nor necessary funds are made available to provide the training prescribed therein. In the past we have suffered much in the name of economy, but we have paid—we have paid through our pocket books and through our life's blood. Are we going to go through it all again? Are we going to forget that a false economy is no economy at all? Are we going to invite other nations to trample upon us at will?

World peace is not yet with us, nor are we yet ready for it. There has been no world peace in the past fifteen years. In the United States every generation of our existence has participated in war. We have had one year of war for every three years of peace. Neglecting minor Indian campaigns, the average length of peace in this country has been no greater than nineteen years. How, then, can we argue that our sons will not in their turn have to go to war and therefore need no training?

It has been said that "Every war ends in peace," but is it not equally true that every peace ends in war? Let us retain our inherited prejudice against a large standing army if we must, but let us not forget that our citizenry, to be of value in war, must be trained. Let us pray that the youth of our nation may never have to go to war, but let us at the same time put our country on a sound defensive basis that the future may be saved the expenditures and the sacrifices of the past. Let us exert every effort to promote and perpetuate peace between nations, but let us also consider our children and our children's children and forget not that they too may hear *Our Country's Call:*

> Lay down the axe; fling by the spade;
>   Leave in its track the toiling plow;
> The rifle and the bayonet-blade
>   For arms like yours were fitter now;
> And let the hands that ply the pen
>   Quit the light task, and learn to wield
> The horseman's crooked brand, and rein
>   The charger on the battlefield.

Pensions for Widows and Children

A recent article in one of the country's most widely circulated daily papers states that the widows of present day officers and soldiers dying in line of duty or as a result of injuries or illness originating in line of duty would not receive any pension.

The statement was evidently based upon the World War Veterans Act, as amended and approved June 7, 1924, which stops the payment of compensation to widows, orphans and other dependents by the Veterans Bureau, unless the officer or soldier was wounded or injured or contracted illness, prior to July 2, 1921, which eventually caused his death. However, coincident with the passage of the above act the pension laws which do not apply for World War Service and which are adminsitered by the Pension Bureau again became effective.

The following is an official synopsis of the law:

> The widow of an officer whose death resulted from disability incurred while on active duty may be entitled to a pension from the date of his death, regardless of the date of her marriage to him or her financial condition. The rate of pension ranges from $15 to $30 per month, depending upon the rank of the officer, with $2 per month for each of his children under the age of sixteen years.
>
> The pension for widows are as follows:

	Per month
Lieutenant Colonel and all officers of higher rank	$30.00
Major	25.00
Captain	20.00
First Lieutenant	17.00
Second Lieutenant and Warrant Officer	15.00
All enlisted men	8.00

Where the widow's husband served during the Spanish American War, Philippine Insurrection or Boxer Rebellion Pensions of $20 per month are paid if pension is not claimed under the Act in preceding paragraph.

The Secretary of the Army Mutual Aid Association reports that during the past three years the widow of every member who has died during that period has been granted either pension or compensation with two exceptions, and in those cases the officers died from disease developed after separation from the service and not incident thereto.

The Army Mutual Aid Association recommends that all officers report all illnesses suffered by them to the surgeon and even if on d. s., or leave, that written report of illnesses or a statement from

civilian physician be filed officially. The Pension Bureau bases all grants of pension upon the sick and service records kept by the War Department. Statements of members of one's own family are of practically no help.

The Army Mutual further advises that all officers should keep a church or court copy of marriage certificate and birth certificates of minor children for possible use by the family to establish Pension Claim and members of the Association may file such papers in its office for future possible use.

Of all government claims which a widow makes, the pension claim is most trying to handle because of the numerous formal and technical proofs that must be submitted in exact compliance with the law and Bureau regulations. Married officers and enlisted men should do everything possible to obviate the numerous obstructions and delays which can be made to prevent or delay the granting of Pension Claims. Members of the Army Mutual Aid Association should comply with its request for marriage certificates and birth certificates of minor or invalid children. Those who are not members should arrange for the presentation of their claims by a good pension attorney or trust company.

Many widows who are legally entitled to pensions have never been granted claims because they were not cognizant of their own rights and had no friends able to care for their interests.

Coast Artillery Designations

Recently, in a study of one of the publications of the General Service Schools, there was noted a frequent reference to the Corps regiment of antiaircraft artillery as the "205th Artillery (antiaircraft)." In the August number of the COAST ARTILLERY JOURNAL the same designation is employed by a Coast Artillery graduate of these schools. Such a designation is, of course, a violation of the provisions of General Orders No. 5, War Department, 1925.

The Antiaircraft regiments of corps and armies in the field are Coast Artillery regiments and should be referred to as such. A proper designation, conforming to G. O. 5, would therefore be "105th Coast Artillery (A. A.)."

Though we should not, we may occasionally be inaccurate in naming organizations of other branches, and we can, perhaps, forgive members of other branches of the service should they, by any chance, be inaccurate in naming our units; but we certainly should insist that we ourselves be exact in designating our own organizations. When we mention Coast Artillery units, let us call them "Coast Artillery."

The President on National Defense

[Reprinted from the Chicago *Tribune*]

It is to be inferred from the President's remarks at Omaha that he feels we are in danger of spending too much money on national defense. There is nothing less likely. The militarism to which he refers is in this country a bit of jargon with about as much likelihood of becoming a reality as a conversion of the American people to Mormonism. There is nowhere in the world a people more disposed than ours to save money on a military establishment or to put an extreme reliance upon international treaties and understanding for the preservation of peace. At this time especially, as no one has more reason than Mr. Coolidge to be aware, the nation is all for reduction in public expenditures or at any rate in taxation, and as the state of the great powers is such as virtually to suspend the possibility of attack upon us for some years, an argument that this is the time when we can safely retrench on national defense seems well nigh unanswerable. The President was never so little in danger of contradiction as when he declared that "our people have had all the war, all the taxation and all the military service they want."

But that is no new situation for us. As a matter of fact, we are passing through a period like that which followed the Civil War. Then the American people were serenely certain they would never fight another war. The Army disappeared. The Navy disappeared. The Army became a constabulary devoted at first to chasing Indians and later to cutting grass. The Navy was reduced to the minimum and made no progress worth speaking of. In the eighties William C. Whitney, Grover Cleveland's Secretary of the Navy, began to modernize the fleet. Mr. Cleveland once threatened Great Britain with war, but he had nothing to fight it with if the threat had been called. In 1898 the nation, and especially the seaboard states, were glad the Navy had been modernized, not excepting Mr. Coolidge's home town. It was not till 1916 that a real step was taken toward modernizing the Army as a military organization expected to fight under modern conditions.

These are not historical reminders intended to justify inordinate expenditures upon the Army or Navy, but they illustrate our opinion that if the President has a fear that mysterious forces will take possession of congress and induce it to spend a dollar more than it has to on the Army or Navy, he would be well advised to dismiss it. We agree with the President that, except during war, our defenses are as good as they ever were. But they have never been good in peace time, though thus far we have escaped from paying as disastrous a penalty for this gambling with safety as we shall have

to pay some day if we keep it up. Our plain duty, with respect to national defense, is to induce adequate expenditure, just as one keeps up insurance year in and year out.

We do not understand the reference to "any organization of men in military service bent on inflaming the public mind for the purpose of forcing government," but we suggest there is a good deal more organization in this country bent on filling the public mind with pacifist fallacies and obstructing proper provision for the adequate defense than of the organization to which he refers, whether it be the fiery Col. Mitchell and his ardent supporters, or the Regular Army or Navy, or the National Guard, the Navy League, or all combined.

The airplane and the submarine and lethal gases have to be studied and energetically developed, while safety demands the continued maintenance of the older basic elements of military and naval strength. There is no danger that we shall expand this strength unduly.

There is war in several quarters of the globe right now and more is threatened. While it is well to strive for the demobilization of racial antagonisms, fears, hatreds, and suspicions, and to try to create an attitude of toleration in the public mind of the peoples of the earth, that is, we submit, a long job, and in the meantime, though we do not maintain a hugh armament, as a sword hanging over other nations, we want what sword we have, small though it is, to be always sharp and ready for our defense.

[Reprinted from the Chicago *News*]

"I am for defense," says President Coolidge. But there can be no adequate defense without an adequate body of regular army officers trained to maintain the provisions of the National Defense Act. The number of officers now on the rolls is less than that previsioned by the act in question.

Victims of Pacifism

[Reprinted from the Portland *Oregonian*]

Just what preparedness for war means is told, in a manner that should impress every American, in the dispatches of James O'Donnell Bennett from a reserve officers' training camp. The incidents related of the World War proved that unpreparedness brings death to men who fight against militarism. Ignorance caused officers to fire shells that did not explode because they had no fuses. Those shells were fired to enable infantry to advance without heavy loss of life. Many lives must have been lost because they gave no

protection. Unpreparedness in that case was actual aid to militarism, yet those who profess most fervent hatred of militarism insist that we shall not train our men to resist it.

Men take training because they want to be prepared for what may come and do their part well. Patriotism would impel them to serve in defense of their country and they undergo training in order that they may win, that they may be equipped to defend themselves and that their lives may not be uselessly sacrificed. Those who have experienced war want no more of it; have a horror of it. Yet their desire to be ready in the event that it should come again is misconstrued as betraying love of fighting.

By thus interpreting the motive of young men who go to training camps every summer, pacifists slander the best of our citizens and oppose the formation of a body of men that would shield them from harm if war should come. The worst delusion prevalent is that by opposing preparedness pacifism prevents war and saves life. By fostering the opinion that peace-loving nations like this could not and would not fight, it encouraged the militarist nations to make war. It sent Britain to war with a small army, ill provided with artillery, and it delayed for two years formation of a large army trained and equipped to take the offensive. During those two years the allies suffered terrible defeats and lost hosts of men, all victims of pacifism. After the United States intervened fourteen months elapsed before American troops took the offensive, and during that period the allies suffered immense losses of men, victims of pacifism. In the Argonne battle the American Army was inadequately trained and was short of artillery and aircraft, and lost thousands of men whose lives could have been saved without reducing the extent of the victory. They were victims of pacifism. The men who take military training are determined that, if the call should come to them to defend their country, they shall not fall victims to that delusion.

Pacifism and Preparedness

[Reprinted from the Portland *Oregonian*]

* * * The correspondent, who, in a letter printed elsewhere * * *, denies the necessity for prudent preparedness for war under present conditions is guilty of the usual evasion of responsibility for the consequences of their acts which marks the contentions of the pacifist-idealists. * * *

The writer holds that "pacifism did not prevail" in our attitude toward the late war, but curiously places the blame for conditions which brought "death to the men who fight against militarism" on

the shoulders of those "who accepted the way of war—hesitatingly—and who did not carry their point of view to its logical conclusion—preparedness." In other words, if there had been preparedness, there might have been less sacrifice of life, as the matter turned out. This is probably true. It is unessential to prove whether organized pacifism or the feeble patriotism which sometimes passed for pacifism resulted in what is conceded to have been an unfortunate situation. The result was expensive and disastrous, in any event. That there may as a matter of fact have been no organized pacifism is beside the question. There was pacifism, in whatever guise, and to the extent that it was responsible for unpreparedness for that which is now known to have been an unavoidable conflict, it cannot escape blame for its acts. * * *

Surely the spirit of justice within our own boundaries does not rest on so slight a foundation that it can be endangered by preparedness for defense.

Armies and navies are necessary for security, as police and criminal courts, and bolts and bars are necessary. They are adjuncts of peace. * * * Mankind has not yet, cannot yet, discard the use of these forces.—*Calvin Coolidge, at Washington, D. C., September 24, 1923.*

PROFESSIONAL NOTES

Seacoast Artillery Firing

[COAST ARTILLERY BOARD PROJECT NO. 220]

EDITOR'S NOTE: *Coast Artillery Board Project No. 220 is one of the most important and most interesting projects ever undertaken by the Board. The* JOURNAL *regrets that the length of the project is such that it can not be given in full in these pages. However, the project with omissions reduced to a minimum, has been secured from the Coast Artillery Board for publication in three parts, of which this is the third. The action of the Chief of Coast Artillery on all parts of the project published appears herein.*

22. *Time-Range (Elevation) and Time-Azimuth Devices.* Prediction oftener than once in thirty seconds cannot be accomplished on manual plotting boards at present in use or adopted. However, it is desirable to provide a means for subdividing the range and azimuth predictions in order that accurate firing data may be available at the guns whenever they are ready to be fired. No thoroughly satisfactory means for subdividing these predictions has been prescribed. For fixed guns the time-range relation board has been used for the interpolation of firing ranges together with "creeping" on the range drum of the gun. There is no serious objection to creeping, but the operations between procurement of a corrected range to the setforward point and the receipt of fire data by the range setters at the gun always have been cumbersome. It has been customary to plot the time-range and time-azmiuth curve on the time-range board and time-azimuth board and then interpolate for the intermediate intervals. It is believed that a more satisfactory means for handling the time-range and time-azimuth relation can be devised, and the Coast Artillery Board is studying this question in Coast Artillery Board Project No. 222, *Time-Range and Time-Azimuth Interpolating Devices.* The Time-Range and Time-Azimuth Spirals described in Coast Artillery Board Project No. 75, *Fire Control System for 155-mm. G. P. F. Guns,* and the use of proportional dividers in connection with the elevation board (Percentage Corrector) and the Deflection Board as described in Coast Artillery Board Project No. 117, *Fire Control Methods for Mortars,* are both satisfactory. It is believed, however, that it may be feasible to develop means whereby the time-range relation may be taken directly from the Percentage Corrector (Elevation Board) and the time-azimuth relation directly from the deflection board.

23. *Spotting Devices for Use in Terrestrial Spotting. a.* Within the last two or three years the Coast Artillery Board has studied, tested and reported on a large number of spotting devices. The need for a standard spotting device is recognized. Opinions differ as to whether it could function in engagements between shore guns and ships, but the Coast Artillery Board is convinced that all seacoast artillery batteries should be so equipped and trained in time of peace that they could correct their fire in action whenever observation of splashes is possible.

b. The spotting organization and equipment should be used during trial fire and all other fire in order that the location and prediction of the target's positions may continue uninterruptedly on the plotting board. When trial shots are fired it is desirable that the data from them be made available immediately upon the conclusion of such fire. These considerations indicate that a standard spotting device should be suitable for use during trial fire as well as fire for effect, and that it should be suitable for use when azimuths of splashes are reported as well as when deviations from a finite or hypothetical point are reported.

c. (1) It is quite generally agreed that adjustment of fire should be based on deviations of splashes from the setforward point. Spotters may report angular deviations of the splashes as right or left of the target; the position of the target at the instant of splash might not coincide with its predicted position as shown upon the plotting board; some of the observed deviations may be due to normal deviations of the ballistic correction due to range changes and other considerations; but these considerations should be weighed by the officer concerned so as to adjust the fire upon the point of expected impact.

(2) Practically every artillery officer has seen splashes at target practice with the unaided eye and then has heard an observer nearby report the splashes as "lost," simply because he did not see the splash in the field of view of the instrument to which his eye was placed. In such target practices as have been held using a sinuous hypothetical course, splashes have deviated widely from the point of expected impact at the instant of splash. The point of expected impact (setforward point) has in many instances been distant from the position of the hypothetical target. These considerations indicate that spotters should be trained to observe splashes either in azimuth or in angular deviation from a known point or target as conditions may dictate.

(3) It is a generally recognized principle in the location of stations for observing seaward fire that the locations should be such as will serve the battery best under varied conditions of visibility. * * * Attempts have been made in many localities to furnish as complete terrestrial visual observation systems as geographical conditions will permit. In some localities it is impossible to provide terrestrial visual observing stations which will permit fire at the maximum range of the cannon to be observed. In other localities it is possible to provide for position finding and observation by locating stations far in advance of, or far to the flank of the target, so that position finding and observation of fire usually will be satisfactory to the maximum range of the cannon to be served. Under conditions of poor visibility, identification of both splash and target may be difficult and identification of the splash only should be sufficient. It follows that standard spotting methods must be limited neither to axial observation nor to measurement of angular deviations from targets.

d. The above discussion sets forth in a general way the primary conditions which a suitable spotting device must meet. Further, a suitable spotting device should be simple in theory or construction and operation; it should furnish accurate results quickly and be reasonably inexpensive; it should be adaptable to bilateral observation of fire and to unilateral observation of fire; it should be suitable for use by fixed as well as mobile seacoast artillery, for use by seacoast cannon of any caliber, and should meet land warfare requirements as well as those in seaward fire.

e. All of the devices tested by the Coast Artillery Board possessed considerable merit and, with certain limitations, offered workable solutions. None of them have been found sufficienty superior to the others to warrant a recommendation for adoption as a standard article of equipment for manufacture and issue. Included among the devices tested were spotting charts. It appears feasible to overcome the chief disadvantages of the spotting chart and to modify it into a device which can meet the requirements stated above to a satisfactory degree. A description of the spotting chart and the proposed modification was described in the September, 1923, COAST ARTILLERY JOURNAL. A satisfactory trial of the ideas expressed in that article cannot be had without the expenditure of some funds for printer's plates and paper. The Coast Artillery Board still has the spotting chart under consideration. Some spotting device should be included in Tables of Basic Allowances, but until a suitable device is developed and adopted as standard, battery commanders may be expected to improvise a device good enough for particular local conditions.

24. *Spotting Devices for Use in Aerial Spotting.* *a.* In connection with Coast Artillery Board Project No. 281, *Test of Spotting Instrument (F. A.), 1923,* the Coast Artillery Board is considering various methods of observation of fire from aircraft. The spotting instrument under test permits obtaining deviations from the target as an origin measured in azimuths from the magnetic north. It is contemplated that deviations be reported by the "Clock code." A simple device for relocating the impacts with reference to the battery-target line has been developed and will be tested in conjunction with the spotting instrument. The data for operating this device are the azimuth of the setforward point, the deviations reported by the observer, and the variations of the compass, that is, the deviations due to local attraction and the declination for the particular locality for which used. For each firing the deviation of the compass is determined by the observer and furnished to the battery firing. Thereafter, both the spotting instrument and the spotting device are operated simply and quickly. It is believed that the spotting instrument will improve the accuracy of spotting from aircraft and that the spotting device will make the deviations from the battery-target line quickly available to the battery commanders. The device for determining the values of deviations with respect to battery-target line is operated by one man, is universal, and is more simple than any spotting device yet developed for use in terrestrial spotting.

b. At the same time that the aerial spotting instrument is being tested it is also intended to test various methods of aerial spotting when the observer does not have the spotting instrument. In these tests, impacts will be estimated and reported with reference to the battery-target line, with reference to the course of the target, or possibly with reference to the magnetic North. Aerial spotting by estimation with reference to the battery-target line in moving target firing offers considerable difficulty to the observer but, considering the difficulty, has been generally satisfactory. It may be said that the good results have been obtained in spite of the difficulties. Aerial spotting by estimation with reference to the target's course, that is, the axis of the ship prolonged by its wake, should eliminate some of the observer's difficulties and probably will give increased accuracy in spotting. A device at the battery will be required for converting deviations to the battery-target line as a reference. A device for accomplishing this is under consideration, but it is difficult to develop a satisfactory method of obtaining the necessary data as to the course of the target without introducing such additional operations on the plotting board as to interfere seriously with

the operations essential to position finding. If it proves practicable to estimate deviations from magnetic North without the special spotting instrument mentioned in 24 *a* above, then the device at the battery for converting deviations to the battery-target line can be the same as that developed for use in connection with the special spotting instrument. This procedure appears feasible. If so, it means that, at the battery, conversion of deviations to the battery-target line can be made quickly without interfering with the plotting operations.

25. *Wind Component Indicator.* The wind component indicator now issued to fixed batteries is not suitable for furnishing wind reference numbers when the direction of the wind is given in mils from the north point, as contemplated by the approved form of meteorological message. A simple modification of present wind component indicators was suggested in Coast Artillery Board Project No. 248. The modification will permit wind reference numbers to be obtained directly from the wind component indicator when the direction of the wind is furnished a battery in mils and the plane of fire is measured from the South point in degrees. The Coast Artillery Board will submit recommendation for the design of a wind component indicator suitable for mobile seacoast artillery, such that proper wind reference numbers for use on the Range Correction and Deflection Boards will be obtained when the direction of the wind is indicated in mils measured from the North and the plane of fire is measured in degrees either from the South or North.

26. *Sights.* Mobile seacoast artillery is not at present equipped with sights suitable for moving target firing. It is believed to be very important that this condition be corrected at the earliest possible date. A Model E 1922 Panoramic sight has been manufactured at Frankford Arsenal for use with 14-inch railway guns. One of these sights is under service test at Fort Eustis. This sight appears to be suitable for moving target firing. It is so constructed that when laid on an aiming point it can be adjusted to read the azimuth of the plane of fire. Thereafter, since the sight is graduated so that the readings decrease as the line of sight is turned clock-wise, it is evident that when a particular reading is set on the sight and the gun is traversed until the line of sight is on the aiming point the gun will be laid on the azimuth corresponding to the reading indicated on the sight. In Coast Artillery Board Project No. 131, *Panoramic Sights for Mobile Artillery,* the Coast Artillery Board recommended that Model E 1922 Panoramic Sights be furnished all railway seacoast artillery and that similar sights be furnished for mobile seacoast artillery; also that all mobile seacoast artillery be equipped with telescopic sights suitable for Case II firing, and that sights for tractor artillery be suitable for Case I firing. Since the sights recommended are for seacoast artillery, it is expected that they will be graduated in degrees and hundredths of degrees, so that one unit of measure for horizontal angles will be used in the Coast Artillery service in operation of the deflection board and pointing of seacoast cannon in direction. Recommendations have also been made that the telescopic sight for mobile artillery be adapted to mounting on an aiming rule, and that aiming rules be issued all such batteries. It is believed that the need for suitable sights for mobile seacoast artillery is a pressing one.

27. *Summary of Fire Control Developments and Their Effect on Training and Supply.* *a.* Summarizing paragraphs 13 to 29 above, it will be noted that seacoast artillery fire control system has been developed as follows:

(1) Terrestrial visual position finding using horizontal base system in connection with multiple base-end stations, multiple vertical base-end stations, and self-contained range finders.

(2) Aerial position finding using the gun as a range finder in conjunction with ballistic firing and observation of impacts with reference to the target.

(3) Position finding and location of impacts by sub-aqueous sound ranging, which is under development.

(4) A flexible communication system to serve multiple base-end stations. It is considerably less vulnerable than formerly.

(5) An improved and less vulnerable time interval system.

(6) A plotting board adaptable for use with multiple base-end stations, for use with aerial position finding, and for use as a relocating board.

(7) Prediction devices—several acceptable ones, but none completely satisfactory. Still under investigation.

(8) Improved meteorological equipment for furnishing speed and direction of wind aloft, ballistic density and temperature, so as to be readily available for use by battery commanders. Still under investigation and development with indications that improvement is to be expected.

(9) Range correction board suitable for all types of seacoast artillery, which is operated deliberately to give a ballistic correction without reference to the time interval system.

(10) A ballistic correction which takes into consideration: height of site (including tide); ballistic wind; atmospheric density; earth's rotation; atmospheric elasticity; projectile weight; and muzzle velocity.

(11) A percentage corrector, which applies a ballistic correction, varying directly with the range, to the actual range to obtain corrected ranges or elevations, furnishes a means for applying corrections due to observation of fire so the corrections vary directly as the range varies, and furnishes a simple method of caring for the range-range relation problem where gun batteries have the range-drum graduated for a standard projectile but are firing a projectile different from standard. Use is authorized but not required.

(12) A range adjustment board for determining the range adjustment correction, showing on what shots based and when applied. It may be used advantageously with any of the prescribed methods of fire adjustment but is particularly adapted to the method which appears most logical to the Coast Artillery Board, viz: A correction at any period based on the mean of the deviations of such number of previous shots or salvos as, after consideration of elapsed time and changing conditions, seems to indicate the most probable deviations of the next succeeding shots, if uncorrected. Use is authorized but not required.

(13) Time-range (elevation) and time-azimuth devices, which permit interpolation of corrected ranges and azimuths at 10- or 15-second intervals. Usable devices are developed but problem is still under investigation with view to improvement. Indications are that satisfactory interpolations ultimately may be taken from percentage corrector and deflection board. Use is authorized but not required.

(14 Spotting devices—usable devices for both terrestrial and aerial spotting have been developed, but none of them are sufficiently superior to justify adoption of any as standard. Still under investigation and, pending adoption of standard, a suitable device must be improved locally.

(15) Sights for mobile seacoast artillery now under manufacture are so designed as to permit laying the gun in azimuth using data furnished by a deflection board, which will be similar to the standard for fixed seacoast artillery.

(16) Deflection Board adapted to use of all types of seacoast artillery, fixed and mobile, is under development. Sufficient progress has been made to justify the statement that one deflection board can be developed for all types of seacoast artillery for Case I, Case II, and Case III firing.

b. A fire control system composed of the elements listed above is applicable to all types of seacoast artillery, fixed and mobile, for firing on moving or fixed targets. If four-gun railway batteries are retained, it may be necessary to make slight changes in some of the apparatus, but the system reduces to a minimum the need for slightly different devices designed for accomplishing the same purpose at different classes of seacoast artillery batteries. Manufacture and supply will be simplified.

c. A system of fire control applicable to all classes of majro-caliber seacoast artillery simplifies training, since fire control sections trained for one class of artillery may function with another class without the necessity of mastering the operation of different apparatus. This is of great importance when it is considered that many Coast Artillery organizations have primary assignments to one class of artillery and secondary assignments to another. For example, a fire control section assigned to fixed mortar batteries could, without any change of training methods, use the fire control apparatus of the mortar battery and perform as a fire control section of a 155-mm. G. P. F. organization. By changing range correction and deflecton board charts it could in fact use the mortar fire control apparatus with the 155-mm. battery. These conditions make possible a common training doctrine and methods for all seacoast artillery units. This fire control apparatus can be used in fixed target firing and will minimize figuring firing data.

d. In Coast Artillery Board Project No. 116, *Fire Control for National Guard,* the possibilities of extending the system to National Guard and R. O. T. C. units is shown. Apparatus used by such units in training can be taken with them in the field and used with whatever artillery assigned. One of the chief missions of regular officers and troops is the instruction of National Guard, Organized Reserves, and R. O. T. C. units. It is of considerable importance that the training of these units be coordinated. Wide differences of viewpoint among experienced artillerymen cannot fail to result in confusion in the minds of beginners.

e. The fire control system developed provides the "tools" for uniform methods in preparation of fire. If these tools are used to the best advantage in conducting fire, uniformly good results will be obtained. A method of conducting fire with G. P. F. batteries was discussed in Coast Artillery Board Project No. 75, *Fire Control System for 155-mm. G. P. F. Guns.* An application of the same system in firing 12-inch fixed mortars was discussed in Coast Artillery Board Project No. 117. Both of these discussions show that the proposed system will furnish accurate ballistic firing data to a battery as rapidly as the guns can be loaded, laid and fired. The conduct of fire must always be dependent upon the methods and judgment of a particular battery commander, but if conducted according to sound principles the system is capable of fulfilling all the requirements outlined in paragraph 9 *c* above as being desirable and meets the ideas of the Board of Officers, mentioned in paragraph 9 *c* above, that desirable features of improved fire control methods should be (1) provision for use of multiple bases, and (2) correction of fire based on instrumental observation of fire.

28. *Preparation and Adjustment of Fire.* *a.* In the last few years there has been very considerable improvement in the conduct of fire at moving targets. It is believed that there is at present considerably less tendency in the service

to apply methods of adjustment which are solely applicable to fixed targets to the problem of moving target firing. There are, and can be, no hard and fast rules of procedure in the methods of adjustment of fire against moving targets. There is no easy road to efficiency in this matter, but there are certain principles applicable to moving target fire which must be mastered by a Coast Artillery officer and applied according to the circumstances existing during each particular firing.

b. Fire control and position finding methods in moving target firing should be such that the obtainable rate of fire is dependent only on the time necessary for the mechanical operation of loading and pointing. Such of the fire control and position finding operations as are performed prior to each shot or salvo must be completed and information delivered to the gun in time to avoid waiting for firing data. In other words the rate of aimed fire should not be appreciably slower than would be required for the same gun using unaimed fire. The rate of fire should in no way affect the accuracy of fire, and this condition is believed to be possible if the fire control apparatus listed in paragraph 30 *a* above is used. Preferably, the fire control operations for adjustment of fire should conform to the following requirements:

(1) Ballistic corrections applied for every commensurable influence which affects the flight of the projectile.

(2) Arbitrary corrections determined from observations of impacts applied in such manner that they will vary for the changing ranges approximately at the same rate as the ballistic correction varies, arbitrary corrections being regarded as adjustments on changes in the ballistic correction. This procedure will result in an ultimate adjustment of the total correction to conform approximately to changes in ranges.

c. Thorough preparation of fire should consist of:

(1) Calibration which should be accomplished at a convenient time by special calibration firings. The importance of calibration cannot be overestimated.

(2) The organization and training of the battery personnel, orientation of gun sights, azimuth instruments, plotting boards and other devices, orientation of guns, checking of range drums by clinometer, and procurement of the essential meteorological and ballistic data.

(3) The determination of the ballistic range and deflection corrections for the range and azimuth at which trial or ranging shots may be fired, using an assumed muzzle velocity, that is, a muzzle velocity based upon history of powder and its temperature at time of firing.

(4) The firing of the trial phase, preferably by trial or ranging shots. (Although usually considered as a phase of adjustment, this is inserted here to simplify the discussion.)

(5) The alteration of the ballistic correction by the amount which may be justified as a result of trial fire, that is, ordinarily, by the mean of the deviations of the trial or ranging shots. In this connection the following discussion is pertinent.

(a) The ballistic correction requires slight adjustment when the initial velocity and atmospheric conditions are measured under Proving Ground conditions. Improved meteorological equipment permits increased accuracy in determining atmospheric conditions, but since devices for measuring muzzle velocity have not been perfected for issue to batteries, the estimate of this element of the ballistic correction is based on very uncertain data. The

practice of ascribing the difference between the observed ranges and the expected range of a group of trial shots as due chiefly to the difference between the assumed velocity and the actual muzzle velocity is warranted on the assumption that errors and omissions in determining the factors which affect retardation are fewer and of less amount than those which affect muzzle velocity.

(b) Trial shots should be used whenever visibility conditions in the vicinity of the target from any cause are such that shots directed at the target probably cannot be observed, providing a registration or trial shot point can be selected such that deviations can be determined. Three or more trial shots should be fired ordinarily from the same gun with the same laying, without reference to the time interval indicators, and as rapidly as possible consistent with precise laying. If, because of lack of information concerning the powder or for other reasons, wide deviations are anticipated, the second and successive shots, as may be desirable, may be delayed for the observation of the preceding shot or shots in order that correction designed to bring the range of the center of impact nearer to the expected range may be applied. Ordinarily, however, such delays during trial fire should be unnecessary and are undesirable. When the series is completed and the mean of range and azimuth deviations determined, fire should be shifted promptly to the target. The interval between the conclusion of trial shot firing and shifting fire to the target should not greatly exceed one minute plus time of flight in the case of 12-inch mortars and should be less with more rapid firing armament. Trial shots are favored for the trial phase of night firing, whether smoke screens are employed by the enemy or not, since splashes are more likely to fall within the searchlight beam when the light is stationary than when following a moving target. The trial shot procedure is satisfactory whenever it can be used. Errors in laying are less likely and determination of deviations probably more certain and accurate when all trial shots are fired with the same elevations and azimuth. They offer the quickest and most accurate means of determining a probably true adjustment correction of the ballistic correction. The trial shot point preferably should be on the predicted course of an enemy target at the approximate range at which it is expected to open fire, and enough in advance of it so that the trial phase (registration) can be completed a very short time before the target arrives within the field of fire. Whenever it is necessary to open fire at once upon the target and not delay for trial shots, and it is possible to observe impacts, resort should be had to ranging shots, which are, in effect, trial shots fired at the moving target. If the target is preceded by destroyers laying down smoke screens the trial shot point should be at a sufficient distance ahead of them to avoid obscuration of impacts from spotting stations for registration. When employed in target practice, the same principles apply except that safety to the towing vessel should have prior consideration over the advantage gained by selecting a point dangerously near the range and azimuth at which fire at the target will be opened.

(c) Ranging shots, that is, trial shots fired at the target, by single piece, alternate pieces, or battery salvo, may be used when deviations of impacts in the vicinity of the target can be determined. Ranging shots have the advantage of avoiding the delay of shifting fire and of offering a possibility of hits during the process of adjustment. Ranging fire should be continuous, that is, there should ordinarily be no delays for observations of impacts. Corrections may be by successive approximations or be based upon the mean

of the deviations of three or more shots. In the former case, the correction based on the deviation of the first shot might not be applied earlier than the fourth shot, but as a rule should be incorporated in the third shot; that for the second shot on the fourth shot, etc. After three or four shots have been observed and corrected for, additional corrections should be based on the mean of the deviations *from the expected range* of not less than three or four of the most recent shots or salvos, whether adjustment fire be conducted, or battery fire for effect opened.

(d) A thorough comprehension of the mechanics and technique of fire control is a necessary attribute of an efficient Coast Artilleryman, whose principal mission is effective fire on moving naval targets. If the procedure outlined above for preparation of fire be accomplished properly and thoroughly, then properly adjusted fire at an enemy ship may be expected. Under those conditions of visibility which we may reasonably anticipate, whether the splashes of any shots fired at enemy ships can be identified and the deviation measured, is problematic. That some impacts may be observed and identified is probable, especially those impacts which may be short. If impacts can be identified and observed and the target can be tracked by the position finding observers, then in general, the deviations of observed splashes can be obtained. The probability that intensive fire on enemy vessels may be susceptible to observation is sufficient justification in itself for both terrestrial and aerial spotting installations, in order that we may overlook no opportunity to deliver the maximum of effective fire in engagements with naval vessels.

g. In the case in which the magnitude of range deviations cannot be determined owing to failure of communication with a flank observer or for other cause, but visibility is such that the determination of deviations of ranging shots may be determined, the most probable position of the center of impact with respect to the target may be determined by observing the relative frequency of shorts and overs and applying a correction which will equalize the number of shorts and overs.

h. Observation of fire is an important aid to accuracy of fire but reasonably effective fire is possible without it. Observation of fire from both terrestrial stations and from the air should be provided in target practice and every effort made to perfect training of terrestrial units and to secure coordination and training in conjunction with the Air Service. In long range firing, both for observation of fire and for position finding, the Air Service is the main dependence of the Coast Artillery, and no efforts should be spared which may tend to build up a proper understanding of combined Coast Artillery and Air Service problems. Proper equipment and well organized and properly instructed spotting sections can furnish information of the magnitude of deviations of those impacts which can be observed, with the required accuracy and within a few seconds after the splash. Ordinarily, when sensing of shots is possible, measurement of deviations should be possible also. How frequent in action either will be possible is a matter of conjecture, but it certainly is reasonable to expect that ships before, or in attempting to pass, fortifications would protect themselves with smoke screens which would obscure practically all splashes, either short or over, except perhaps the abnormally short shots. For example, assume a fleet attempting to gain an entrance to Chesapeake Bay. A successful run-by would enable it to get beyond the range of the fixed defenses. Smoke screens would partially screen its movements and wholly prevent its observation of fire from Fort Story. The masts and

parts of the upper works may be visible above smoke screens sufficiently to permit fairly satisfactory tracking. It is true that the smoke screen hampers the fire of the ship it protects, but under conditions similar to those at the entrance of Chesapeake Bay, it is probable that a fleet would accept that handicap since it could not hope to damage the fortification seriously during the short period the fleet would expect to be under fire. The fleet commander would rely for security on the speed of his ships and the protection of smoke screens, rather than on his own fire. Haze or low lying fog will produce similar conditions, but if observing and spotting stations are well advanced into the field of fire the adverse effect of these conditions, as pointed out in Par. 13 *h* above, will be minimized. No method of conduct of fire is sound which is solely dependent on continuous or even frequent observations of splashes, and consequently on the absence of smoke screens or fog. Preparation of fire and trial shots offer the surest means of conducting a reasonably effective fire when observation of impacts is not continuous or is impossible.

i. The setforward point or the point aimed at in the case of a ship following a zigzag or sinuous course may be located considerably off the course actually taken by the target. This may occur also due to inaccuracies in plotting. Corrections due to observation of fire, therefore, should be based on deviations from the range and azimuth of the setforward point. If range deviations are observed from the target, deviations in the range of the setforward point of expected range may be determined by requiring the plotter to call out the range deviations of the setforward point from the plot of the course of the target. These deviations are then combined with proper signs with the deviations of the splash from the target as determined by the spotting section. This method has been used successfully and compares favorably in speed and accuracy with spotting methods which determine the deviations from the setforward point directly.

j. The fire of minor-caliber armament (including antiaircraft artillery firing on moving naval targets) may be regulated by the same principles and methods as the larger calibers. It is probable that targets will be more numerous and will maneuver more rapidly, which will increase the uncertainty of identifying them by distant spotting stations. Usually, ranges can be determined at frequent intervals from self-contained range finders located near the battery, and the range correction applied through a percentage range correction device with or without a Pratt Range Board. *A varying correction which adjusts automatically the range correction to the rapidly varying ranges is of equal or greater importance than for batteries of the primary armament.* Such a correction is approximately compensating over wide variations in range, whereas a flat correction is not. The procedure may be as follows:

(1) Registration as a point on the predicted course of the target at the approximate range at which it is desired to open fire.

(2) Application of the range correction as a percentage correction by means of the percentage corrector mentioned in Par. 19, above.

(3) Adjustment of the correction by observation of fire when satisfactory observation is possible. Such changes in adjustment should be conservative. The trial shot correction should be regarded as more reliable than a correction based on either sensed or observed deviations equal to or fewer in number than the trial shots, unless considerable time has elapsed since trial shots were fired.

k. The preceding paragraphs describe range adjustment. Azimuth (deflection) adjustments do not offer the complications that range adjustments do,

and generally speaking are accomplished more simply. Deflection adjustments are carried on simultaneously but independently of range adjustments. Except in firing at ranges beyond 15,000 yards, or at elevations above 30°, or where observed deviations in direction are greater than 0.50° (9 mils) adjustment may be made by correcting by an angle equal to the mean of the lateral deviations of trial or ranging shots. With successive approximation and salvo center of impact methods, the deflection correction may be applied directly as the total of the angular deviation in direction of the last shot or mean of latest shots. Under these conditions, when firing by Cases I and II, correction is sometimes applied directly by the gun pointer, as indicated in Par. 7 *g*, T. R. 435-221. This method, sometimes called "jumping the splash," is advisable only with guns of less than twelve inches in caliber. Under the conditions stated, these methods usually give azimuth (deflection) adjustment in a few shots. Beyond the limiting range or elevations of observed deviations given above, the amount of the correction should be determined by the same method as in the range correction, using always the method of adjustment being used for range. The correction is expressed in angular measure, its linear value is always proportioned to the range, and it may be applied directly to the ballistic azimuth or deflection correction.

l. (1) The difficulty in holding an established adjustment in range and deflection whenever the powder charge is changed has not been mentioned in this paper. A change from one charge to another changes the trajectory and corresponding ballistic corrections enormously. The following table shows the effect on the maximum ordinate of changing charges with the 16-inch gun for the 2340-lb. projectile:

Range, yds.	*Charge*	*Max. Ord. yds.*	*Charge*	*Max. Ord. yds.*
32,400	¾	9,000	⅞	18,000
39,300	⅞	12,000	Full	23,000

To show the meaning of this table, consider the case where a target was moving out and the battery was shooting at the deck of the target. For 25,500 yards to 32,400 yards range, the ¾ charge would give maximum penetration of the deck. At 32,400 yards the maximum range for the ¾ charge would be reached and a change would be made to the ⅞ charge. In making this change, the maximum ordinate at this range would change from 9000 yards for the ¾ charge to 18,000 yards for the ⅞ charge. Such a sudden change in trajectories would probably destroy previous adjustment.

(2) Where velocity curves for adjacent zones have been connected with each other in accordance with the ratios of the normal velocities of the adjacent zones, the velocity corrections from zone to zone appeared to vary properly in all practices. However, the Ordnance Department has been requested to study and report as to the most suitable method for carrying velocity corrections from one zone to another.

(3) Present fire control methods contemplate deflection corrections for ballistic wind for changing azimuths of the plane of fire and for varying maximum ordinates. The method of application of cross-wind effects contemplates the use of a family of combined cross-wind and drift curves plotted for each zone. The zone elevation and wind reference number are used as arguments in entering the chart. Provisions for arbitrary cor-

rections still will be necessary, but study and experiment are necessary as to the proper way to apply such corrections at different elevations in different zones. For guns, an arbitrary correction in angular measure for lateral deviations should suffice and can be cared for on a simple adjustable scale of angular units. The linear magnitude of such a correction then should vary with the range. For mortars, such a scale and such a range should be satisfactory in all zones (with the same projectile) for the elevation at which the lateral angular deviation was determined. Within any zone at elevation different from the elevation for which the correction is suitable, an error in azimuth should be anticipated. This error is of secondary order and its magnitude may be negligible, but as noted above, study and experiment are necessary before expressing definite conclusions on this point. The question of applied deflection corrections within a particular zone in high angle fire, and when passing from zone to zone, is under investigation.

CONCLUSIONS

29. Those parts of this project believed to require action are summarized in the following conclusions:

a. That a comprehensive doctrine relative to seacoast artillery in coast defense operations should be published and distributed to the entire service in the same way the Field Service Regulations are given general distribution. [Par. 3 *d.*]

b. That the future importance and effectiveness of prewar primary armament is sufficient to justify keeping it equipped with a fire control system ready for service, which is equally as effective as that provided for post-war primary armament. [Par. 6 *b* (3).]

c. That an armor piercing projectile should be developed and made available for 155-mm. GPF guns for use in coast defense. [Par. 6 *c* (2).]

d. That steps be taken to obtain increased ranges from the present 7-inch and 8-inch guns so that they may outrange medium-caliber guns on the types of light cruisers now building. If 7-inch and 8-inch guns cannot be given sufficiently increased ranges to outrange the guns of light cruisers, that consideration be given to making another medium-caliber type available for this purpose. This armament should be provided with A. P. projectiles. [Par. 6 *d* (2).]

* * * * *

f. That in localities where the terrain permits, some terrestrial observing stations should be advanced sufficiently into the field of fire to give position finding data throughout the limits of the possible range of a battery. [Par. 13 *h.*]

* * * * *

h. That two observing stations per battery are not sufficient. Permament multiple stations should be provided when possible and where not provided they should be improvised. [Par. 13 *j.*]

i. That the tactical situation may require both concentration and distribution of fire; that a single high-powered gun frequently will be a suitable assignment to a single enemy target; and that the fire control and position finding systems for batteries of more than one high-powered gun should be such as to permit fire on one target or on as many targets as there are guns in the battery. [Pars. 14 *a* to *f.*]

j. That for coast defense missions, one 14-inch or larger-caliber railway cannon, with personnel therefor, should constitute a battery, and that Tables of Organization and Training Regulations 435-225, *Battery of Railway Artillery,* should be amended accordingly. That if such one-gun batteries for coast defense missions are not approved, then a complete fire control and position finding system for each railway gun of 14-inch or greater caliber should be provided. [Par. 14 *g.*]

k. That it is impracticable for a single fire control and position finding system for railway artillery to furnish data for more than two directing points. That all railway artillery, if less than 14-inch caliber, should have only two guns for coast defense missions, and that Tables of Organization and Training Regulations 435-225, *Battery of Railway Artillery,* should be amended accordingly. [Par. 14 *g* (2).]

l. (1) That the determination and use of the predicted point be not required, provided a suitable check-back system be used, and that T. R. 435-221 be amended accordingly. [Par. 15 *h.*]

(2) That no definite predicting interval or frequency of predictions be prescribed, and that T. R. 435-221 be amended accordingly. That the prediction interval should be as small and the frequency of predictions as great as the flow of position finding data and state of training will permit. [Par. 15 *i.*]

m. That consideration be given to furnishing ballistic density in the meteorological message in tenths of a per cent by adding one figure to the present message. [Par. 16 *c.*]

n. That the efficiency of the present meteorological service in various coast defenses be investigated with a view to determining whether the service is functioning properly and what use is made of meteorological data furnished. [Par. 16 *e.*]

* * * * *

p. That the fire control apparatus listed in Par. 27 should be given sufficient service tests to determine its suitability for the purposes for which designed, and if found suitable, should be prescribed as standard for National Guard, Reserve, and R. O. T. C. units and for the use of Regular troops in training all such units. [Pars. 27 *a* to *e.*]

Recommendations

30. It is recommended:

a. That necessary action be taken in conformity with "Conclusions," Pars. 29, *a* to *p,* inclusive.

b. That no part of this project be published in the Coast Artillery Journal unless the Chief of Coast Artillery so directs.

ACTION BY THE CHIEF OF COAST ARTILLERY

War Department, O. C. C. A., April 8, 1925—To President, Coast Artillery Board (through Commanding General, Third Coast Artillery District), Ft. Monroe, Virginia.

1. This project has been given very careful consideration in this office and, with the following exceptions, and those of Par. 2, this indorsement, it meets with the approval of the Chief of Coast Artillery:

* * * * *

Page 10, *c* (3). New sights for the 155-mm. gun and for railroad guns are under development and, to meet immediate requirements, the present sights are to be modified along the lines suggested by the Coast Artillery Board. Fire control equipment for 155-mm. gun batteries as recommended by the Coast Artillery Board is now being subjected to further service tests and probably will be adopted if the reports are satisfactory.

* * * * *

Page 10, Par. *d* (1). The number of 14-inch railway guns will be increased as rapidly as funds can be secured for that purpose.

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Page 30, Par. 15 *h.* The matter of discontinuing the predicted point is still under investigation by the Office of the Chief of Coast Artillery.

* * * * *

Page 33, Par. 17 *e*. Range Boards, Model 1923-E, will be provided as rapidly as funds become available for that purpose but with the limited appropriations for "development and manufacture" it will be some time before these boards can be supplied in any quantity.

Page 42, Par. 26. New sights for mobile seacoast artillery are being developed by the Ordnance Department along the lines suggested by the Coast Artillery Board. Due to shortage of funds it is probable that it will be some time before this development can be completed but modifications are being made to present sights to meet immediate requirements.

2. This office concurs in the conclusions of the Coast Artillery Board as given in Section III with the following exceptions and modifications:—

a. The Commandant, Coast Artillery School, has been requested to prepare a study on "Doctrines of Seacoast Defense by the Coast Artillery Corps."

b. Approved in so far as funds available now or in the future will permit. In this connection information is furnished that at the present rate of appropriations it would take approximately thirty-five years to complete the fire control systems for the modern long range batteries now installed.

c. A new point fuse for the 155-mm. shell is being developed by the Ordnance Department which will considerably increase its ability to penetrate steel plate. No effort is being made at the present time to secure armor piercing shell. It is possible that some gun will have to be provided to meet the lightly armored cruisers of the 10,000-ton class but if so it is probable that an 8-inch railroad gun will be the answer. An 8-inch railroad gun which is under development by the Ordnance Department is expected to have a range of approximately 35,000 yards.

d. The elevation of the 7-inch railway guns on hand can not be increased without structural changes that would be too expensive in view of the fact that these guns have already seen considerable service. A 45-caliber 8-inch Navy gun is now being mounted on the 12-inch howitzer railway carriage and is expected to give a range of approximately 35,000 yards.

* * * * *

i. It is believed that with long-range, high-powered guns a maximum of two guns per battery gives only sufficient gun power to insure a reasonable chance of putting a ship out of action in the minimum required time. Therefore, it is not believed to be desirable to incur the expense of a separate position finding system for each gun in two-gun batteries.

j. See remarks under *i*.

l. (1) and (2). No decision on this point can be given until a report is received from Panama on Coast Artillery Board Project No. 117 in which the system does away with the predicted point for each setting of the mortar.

m. The Ordnance Department is being consulted in this matter.

n. This matter is being investigated during training inspections.

* * * * *

p. It is expected that during the coming target practice season regular army Coast Artillery commands will utilize the fire control appliances listed in Par. 27 and a careful study of target practice reports of the batteries so equipped will be made in this office. Whether such apparatus will be adopted for National Guard, Organized Reserve, and R. O. T. C. units will depend upon the status of funds available for the purchase of the necessary equipment.

3. The necessary action will be taken to carry out the conclusions of the Coast Artillery Board as mentioned in Par. 29 as indicated in Par. 2 of this indorsement. The Chief of Coast Artillery has no objection to the publication of this project in the COAST ARTILLERY JOURNAL so long as the action indicated in this indorsement on the project is published also.

* * * * *

Artillery Observers in Martin Bombers

It has been usual for an artillery observer, while observing artillery fire from Martin Bombers, to take position on the upper deck of the bomb-bay, where he may either sit up or lie down, as shown in Figs. 1 to 4. No particular safety precautions to keep the observer from being blown from the airplane have been taken, since it was considered that the four upright struts with the crossed wire braces between them would afford ample protection.

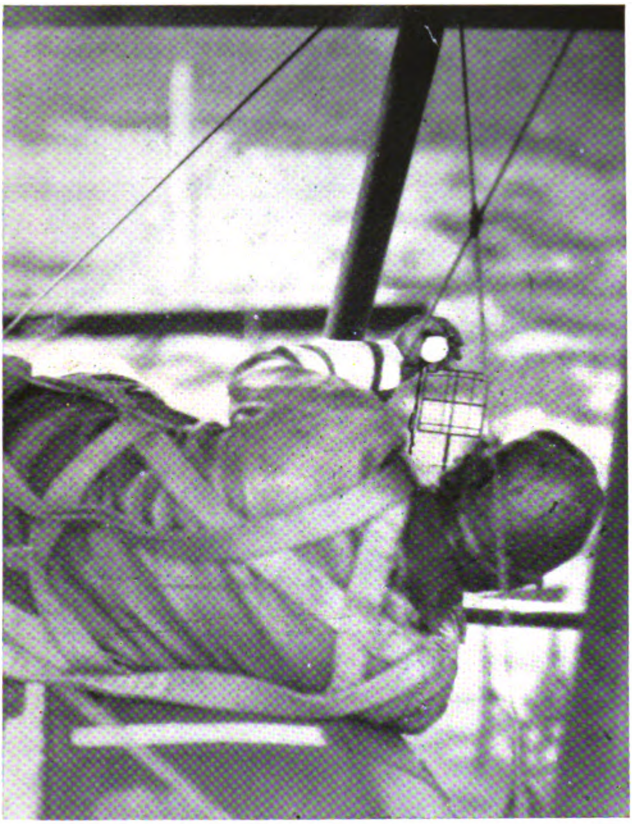


FIG. 1. POSITION OF OBSERVER ON BOMB-BAY AS SEEN FROM THE NOSE OF THE AIRPLANE
Note records on arm

As can readily be seen from the illustrations, the observer finds himself in awkward and inconvenient positions while engaged in work calling for accuracy in estimates and nicety in judgment. By strapping his records to his left arm (see Fig. 1) and by bracing himself against the struts and wires, he leaves his hands free to use the instruments with which he is provided and which he must be careful not to lose. By changing his position frequently, moving from one side of the bomb-bay to the other, he keeps the target in sight as the airplane dips and circles in the air.

Fig. 2. Position of Observer on Bomb-bay as Seen From the Rear of the Plane

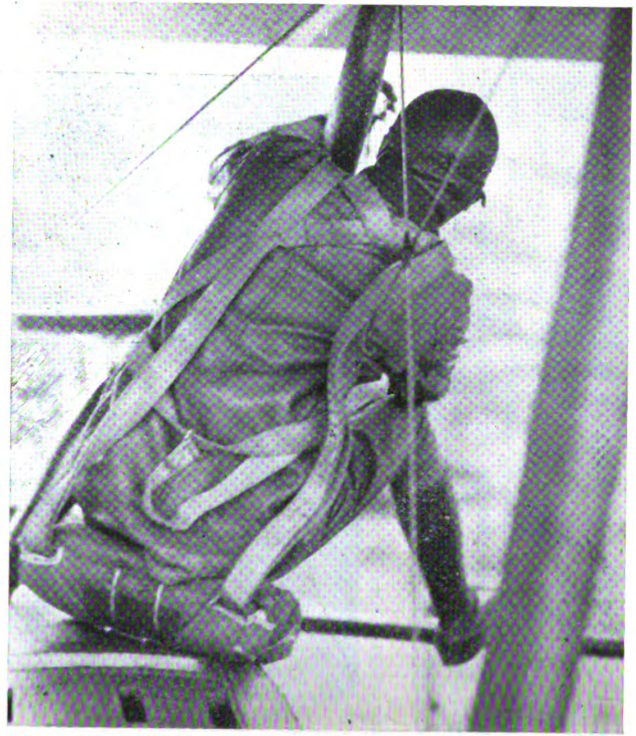


Fig. 3. Position of Observer Sitting on Bomb-bay as Seen From the Nose of the Plane

Fig. 4. Position of Observer Sitting on Bomb-bay as Seen From the Rear of the Plane

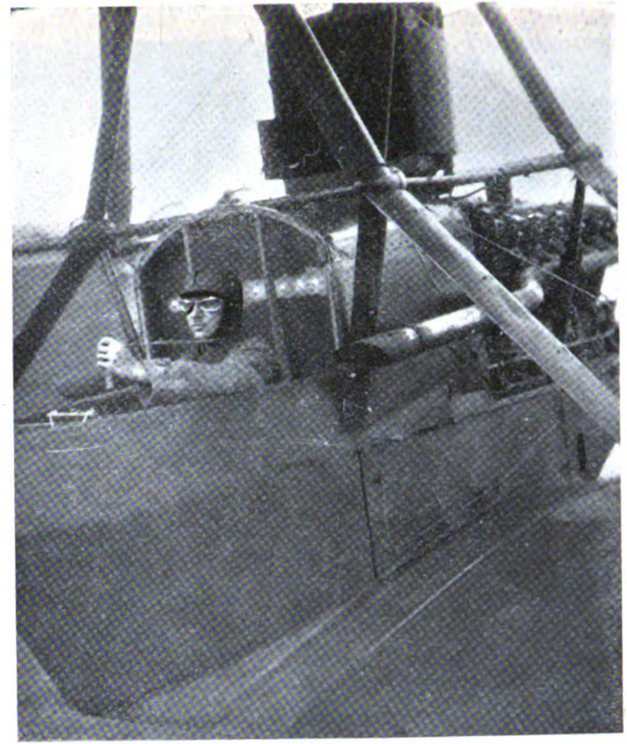


Fig. 5. Position of Observer in Nacelle as Seen From the Right Rear of the Plane

Fig. 6. Position of Observer in Nacelle as Seen From the Radio Cockpit. Note the Board for Altimeter, Watch, and Records

Fig. 7. Position of Observer in Nacelle as Seen From the Bomb-bay

Despite its inconveniences and the element of danger involved, the position, since it appeared to be the best place for observation, was continued in use until a near-accident during the joint Antiaircraft-Air Service tests of the past summer indicated the desirability of a safer and more convenient location for the observer.

During a night-observing mission in the latter part of August, the rip-cord sheathing became detached from the canvas covering of the parachute in such a manner that the parachute could be opened in case it were pulled in any way. This occurred when the observer changed his position from one side of the bomb-bay to the other. The pilot chute of the parachute was at once pulled out to the rear. The observer averted disaster by rolling over on his back and gathering the silk under him. With the assistance of the radio officer, he released himself from the parachute, which was then disentangled and stowed in the rear cock-pit.

Attention having been brought sharply to the danger of a position on the bomb-bay, a better place was sought. After some investigation, it was decided that, for efficiency of observation, safety, and comfort, a location in the nacelle behind the engine was superior to any other. The turtle-back of the nacelle is removed and the observer sits in the lower half of the nacelle. One or two kapock cushions on the floor brings the observer's head to the right height. Figures 5, 6, and 7 show the observer in this location. A board for records and altimeter is attached to the cross braces of the nacelle, as shown in Figs. 6 and 7. The target is in full view of the observer at all times from this position.

One possible danger exists, as can be seen from Fig. 5, in that the exhaust pipes discharge the exhaust gases in close proximity to the observer. When the turtle-back is removed, the stream line in rear of the engine is broken, and it was at first feared that the partial vacuum thus created would tend to suck in enough gas to be harmful to the observer. Actual trial does not show this to be the case. The position has been occupied on missions lasting from two to three hours, and the observers report no ill effects from carbon monoxide. The change should result not only in greater safety to the observer but also in greater accuracy in his work because of his more comfortable location.

Summer Encampment of the 250th Coast Artillery

By 1st Lieut. S. R. Dows, *250th C. A.*

Last year California boasted only one Coast Artillery Regiment. Through the efforts of the Adjutant General, R. E. Mittelstaedt, a second regiment was authorized. The old 250th Coast Artillery was split, those batteries in the south forming the nucleus for the 251st C. A. (Harbor Defense), while the seven batteries in San Francisco expanded to form the present 250th C.A. (Heavy Tractor).

Requisitioning of supplies and equipment and the perfecting of the organization required a considerable portion of the year. The arrival of the materiel was delayed—many of the fire control and orientation instruments arriving only in time for reshipment direct to camp in the original packing. The tractors and guns arrived late in May allowing only four instruction periods prior to the July Fourth parade in which the eighteen tractor-drawn guns appeared.

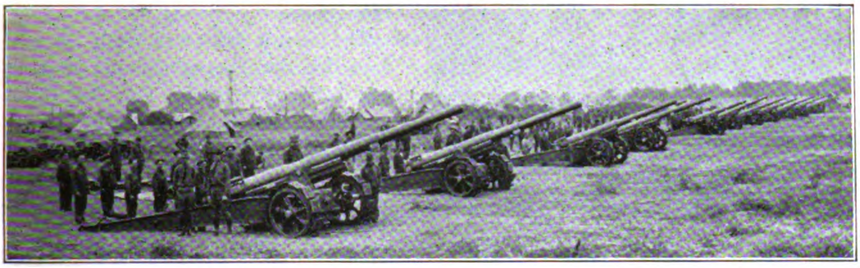
The order for the encampment and maneuvers divided the period from August 1 to 15 into three phases: (a) The transportation of the Regiment to Santa Cruz, the emplacing of the guns, establishing of lines of communication, survey of base lines, and the installation of base end and spotting stations; (b) The

perfection of base lines and communications and intensive artillery drill; and (c) The calibration of and target practice with two guns per battery at fixed sea targets. Obviously the first phase required that the return trip to San Francisco be taken into consideration.

ON THE SANTA CRUZ GRADE

Of the three phases, the first was perhaps the one in which the regiment was most vitally concerned. To fire the guns was no more of a task than had been accomplished in past years. True there were many new devices which made it a bit more difficult for the officers, but the big question from the start was transportation,—the moving of the guns with the tractors. A march graph, showing

for any minute of the trip where any organization would be, was prepared to accompany the march orders. The greatest divergence from this schedule was four miles, which is quite remarkable considering the limited experience on which to base the graph. The regiment was divided into two columns. The tractor-drawn guns with a truck and rolling kitchen, two motor cycles, and a Dodge touring car comprised the Heavy Train. The Light Train consisted of trucks for the personnel and light baggage, with rolling kitchens and a Cadillac and Dodge touring car. The two columns made the trip in three and two days, respectively.



GUN PARK NEAR THE HIGHWAY

Naturally enough the interests of all were centered in the Heavy Column. Among the tractors, one burned out a main bearing about twenty miles from San Francisco and was replaced by one brought from the Armory. A second tractor burned out a main bearing at Alma, a distance of fifty-five miles from San Francisco. A Liberty class B truck was detailed to drag the gun over the grade into camp and no further trouble was experienced from that source. The failure of these two bearings is attributed to a stoppage in the oil line or to foreign matter in the oil which stopped up the strainer. A different grade of oil was used on the return trip and other precautions taken so no trouble was had with bearings.

EN ROUTE TO SANTA CRUZ

IN THE SANTA CRUZ MOUNTAINS

The trip to Santa Cruz is eighty-one miles and required for the tractors some twelve hundred gallons of gasoline. For the nine hundred and seventy tractor miles the fuel consumption was about one and one fourth gallons per mile. This mileage attainment indicates very efficient handling of the tractors. The weather was particularly warm and the grade over the Santa Cruz mountains rises from sea level to 1577 feet at the summit. Despite the fact that the Light Column was on the grade during the heaviest of the Sunday traffic, there were no accidents. All possible precautions were taken to insure safety and

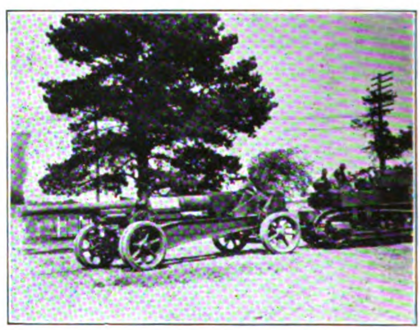
comfort to civilian machines. The traffic police aided in warning motorists and keeping machines on the move. By running the trucks at hundred-yard intervals, the regular Sunday traffic was able to pass the column with ease. Among the trucks there were no serious difficulties encountered.

While at Santa Cruz, all trucks and tractors were overhauled and, as a result, the trip home was made without serious trouble. The tractor which had been left at Alma on the down trip was put into service at that point, and the tractor from Belmont which had been the first to fail, was put in action at Palo Alto.

On the Palo Alto Road

The return trip was made in two days by the Heavy Column and in one day by the trucks. This feat quite surpassed the expectations of everyone. Prior to the departure there had been some discussion relative to the possibility of making the haul in less than four days. A light repair car accompanied the guns and it is largely due to the expertness of the maintenance crew that the trip was possible in such fine manner.

Camp Santa Cruz, California.—Reference to any good military map of the Pacific Coast might well lead to the selection of Monterey Bay as the logical point of attack for landing parties. From there into San Francisco, the travel over good roads would be comparatively easy and the approach to the bay region would be most strategic. The shore line at Santa Cruz is especially adaptable to the needs of a landing party. It is quite appropriate therefore that Santa Cruz should have been selected for the 1925 Maneuvers and Summer Encampment of the 250th Regiment.



At Palo Alto

The site chosen for the camp is a flat tidal plane along the beautiful Sea Cliff Drive. A quite conventional design was followed in the pitching of the canvas, and just west of the camp proper the guns were emplaced to cover the field of fire which was to be used. Climatic conditions were all that could have been hoped for. During the training period a fog hung over the coast which made work more comfortable and interfered practically none with the visibility. The fog dispersed very obligingly during the two days of firing leaving almost ideal weather. Practically no interference was experienced from shipping.

Upon arrival in camp, an orientation detail from each of the three battalions ran the necessary traverses and triangulation surveys for the establishment of base lines. These three surveys were based on three points which had been located from a civilian survey. Three sets of base end stations were installed and the base lines tied in with the battalion directing points. A detail under the regimental orientation officer located the spotting station on the left flank of the regiment for unilateral spotting.

Range Finding System.—Each of the three battalions had an independent range finding system consisting of horizontal base end stations, plotting and spotting stations. Each battalion system served its two batteries, there being one directing point midway between the two batteries of each battalion. The three systems were interconnected through the regimental switch board and to the regimental radio station. Headquarters battery established and operated a station for obtaining surface meteorological data which was furnished for all stations every half hour. Azimuth instruments were used in the base end stations—some of them graduated in mils and some in degrees. Except for the Cloke plotting board and the Pratt range board, all the instruments in the plotting room were improvised or built by the organization. All were approved devices as described in T. R. 435-221 or Coast Artillery Board projects but not yet issued to the ser-

Firing for Record

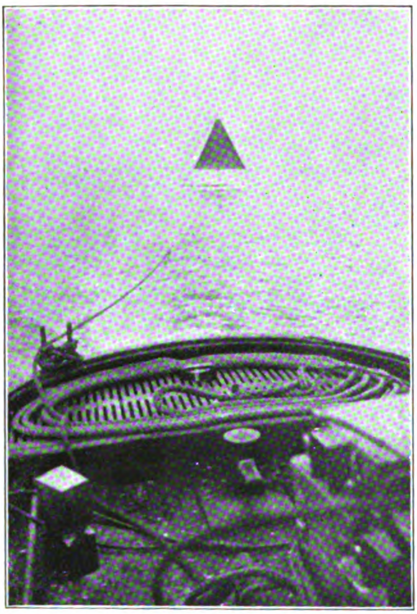
vice. These instruments were set up in a 12′x 12′ wall tent which very comfortably accommodated the personnel.

Communications.—The communciation system installed was that described in Coast Artillery Board Project No. 315, "Communication System for Mobile Seacoast Artillery for Firing on Moving Naval Targets," (Coast Artillery Journal, February, 1925). The installation was complete except for regimental and battalion posts which were not deemed necessary. The working of the system was very satisfactory, with no more trouble than usually occurs during the firing at fixed defenses.

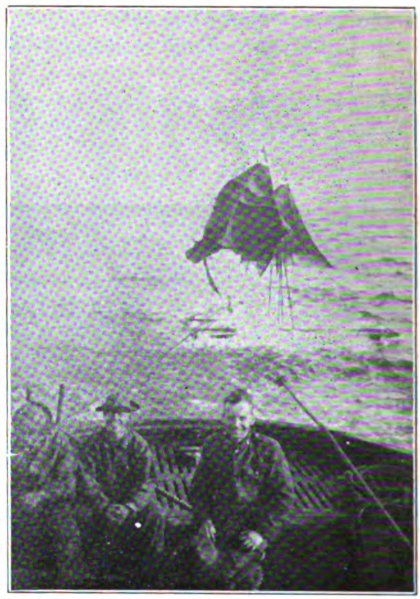
Conduct of Firing.—The preparation for target practice included the checking and adjustment of all instruments and boards, cleaning of projectiles, testing of primers and firing mechanism, and the coordination of plans for spotting. The schedule called for the firing to be completed in three days. A day and a half was allowed for the six calibration problems and a similar period for the adjustment problems. To indicate at once in a general way how well the firings

were conducted it may be stated that the firings were completed in two days. On August 11 the six batteries each conducted a calibration shoot using a fixed target at about mid range. A complete set of data was taken for the purpose of calibrating all twelve guns so that in the future any combination of these guns can be effected.

On August 12 the adjustment problems were fired, each battery having an ammunition allowance of twenty shots. In past years the trial shot method had been used almost entirely so the bracketing and successive approximations methods were selected for this firing. One battery of each battalion used bracket-



BEFORE



AFTER

ing and the other used successive approximations. All problems required adjustment of fire on a fixed target, using unilateral spotting. Range corrections were applied in the plotting room while deflection deviations were taken care of by the gun pointers. The battery commander was left free to supervise any phase of the firing which might call for his attention. The impact board was used by the range officer in making the corrections which were applied as a percentage on the proper scale of the percentage corrector. During the adjustment firing all batteries scored hits. Two pyramidal targets were completely demolished. The materiel functioned without interruption or accident. For all batteries firing, the average developed probable error was 73 yards as compared with the proving ground value of 45 yards. The average of the probable errors from the calibration firing was 54 yards. The best firing was done in seven minutes and twenty-two seconds, securing four very good hits. The regiment as a whole scored better than ten per cent of hits.

The entire maneuvers were unanimously declared successful and excellently conducted. To Colonel R. E. Mittelstaedt the 250th Coast Artillery owes a sincere vote of appreciation. It was his initiative which organized the regiment and

commanded it through the test. To Major T. C. Cook, C. A. C., the entire regiment is unanimous in its words of gratitude. Others there were whose loyalty to the regiment was of inestimable value but, space limits further acknowledgment. The guns were taken to Santa Cruz in record time. They were emplaced, oriented, and fired in a true military manner and returned to the home station without mishap. Thus it was that the 250th C. A., a regiment whose enviable record dates back to 1854 and the Civil War, added another chapter to its history. Into that chapter must be written the highest praises from those who officially and unofficially visited the most extensive maneuvers ever held by Coast Artillery troops on the Pacific Coast.

I Wish That I Knew But I Don't

By MAJOR CLAIR W. BAIRD, *C. A. C.*

Captain, Coast Artillery Rifle Team

EDITOR'S NOTE: *As noted in the November* JOURNAL, *the Coast Artillery Rifle Team won seventh place in the National Matches at Camp Perry, Ohio. One is apt to gather from the following article that the Team Captain feels that a bit of an apology is due from the team for not attaining a greater success. In this the* JOURNAL *disagrees. The Coast Artillery was represented by a worthy team under an efficient Team Captain and an excellent Team Coach. When one considers the limited facilities for small-arms target practice existing at most Coast Artillery stations, one must admit that our team made an excellent showing. Seventh place unquestionably represents a lot of hard work, some details of which appear on another page. Other teams in the past have stood higher, but that does not necessarily mean that they were any more proficient nor that they worked any harder. The* JOURNAL *believes that Coast Artillery participation in the National Matches is of great importance, and it confidently expects to find our team at Camp Perry next year, backed by the entire Corps, exerting every effort to win and conceding place to none until the last shot is fired.*

After the Wakefield daily bulletins showed that we had the hardest hitting squad in the history of the Coast Artillery Rifle Team, many officers of the Corps must be curious as to why we couldn't do better than seventh in the National Rifle Team Match in 1925.

My answer is the heading to this article.

Theories or alibis or whatever you want to call them, I have a plenty, but——

It is believed, however, that could the squad have been kept going on its regular schedule of practice there would have been a different story. The grind at Wakefield was steady and strenuous. When the squad arrived at Camp Perry the Small Arms School was in session and few, if any, practice targets were to be had at any price. One was fortunate indeed if more than one firing point was available in a day and then for but a short period of time. Then that particular firing point would not be seen again for nearly a week. Such haphazard training after a systematic daily grind was detrimental not only to physical training but to morale as well. Naturally the "come back" to that is, "The other teams were in the same boat, weren't they?" Maybe yes and maybe no. Yes, as far as getting targets was concerned, but I have my doubts as to whether any other team followed the same steady grind that our team did. I wouldn't do it again knowing what I do now.

And another thing—with the exception of six or seven men the squad was composed of men who had never attended a tryout or a National Match before. Major Fulton's policy was never to put a man on the team his first year if it could be avoided. It is a sound policy but could not be followed this year. It is no small thing to require a new man to shoot on a team his first year. Everything is strange. He is worried about his time allowance; range officers, slow targets, and poor marking "get his goat," and he is almost sure to get the "buck."

It is realized that many officers are opposed to the Coast Artillery having a rifle team on the grounds that it takes officers away from otther duties, that no benefit is to be derived therefrom and that the whole thing is a "joy ride" for all concerned.

The rifle team does take officers away from other duties, but so do training camps and a hundred other activities. The question seems to boil itself down as to whether any material benefit accrues not only to the Corps but the country as a whole. I claim that it does. We spend millions of dollars and utilize hundreds of officers on training camps each year and yet we object to sending a few officers or men to Camp Perry, which is nothing more or less than an immense training camp and one which is educating the nation in preparedness on a scale such as no other camp in the country is doing. There are but six service teams and yet in the National Rifle Team Match nearly one hundred teams competed. During the period of the camp there were some twenty-five hundred men who took part in the matches. These men are learning to *shoot* and learning how to teach others to shoot. A little of it won't hurt the Coast Artillery.

Any officer who has a whit of *esprit de corps* will agree that having a rifle team in the National Matches is not only desirable but beneficial. It gives the Corps a standing and recognition among the other services, among the National Guard, and civilians from every state of the Union that it would be impossible to attain in any other way.

In this connection a Coast Artillery officer was sent to Camp Perry this year to act as a chief range officer. It was his first visit. When he left he said that heretofore he had had no idea of the magnitude of the National Matches, of the benefits that were to be derived therefrom nor of the great interest taken in them. He further stated that he was proud to have the Coast Artillery Corps represented, and added "I'm for this thing from now on, and anything I can do to help it along I'll be glad to do."

I wish more officers could visit Camp Perry.

As to it being a joy ride—the following schedule speaks for itself. I wonder how many officers in harbor defenses worked as hard.

Up at 6:00 A. M.
1 mile walk
Breakfast, 7:00 A. M.
Commenced firing, 8:00 A. M.
Ceased firing, 11:45 A. M.
Dinner, 12:00 Noon.
Commenced firing, 1:00 P. M.
Ceased firing, 4:30 P. M.
2 miles run.
Supper, 5:30 P. M.
2 miles walk.
Bed, 10:30 P. M.

And they were ready for bed!

Once in a while, when things were not going just right, when the temperature was 90° or better in the shade, and when I particularly needed an excellent shot who "couldn't be spared," I have wished that some of the "objecting" commanding officers could be down on the firing lines. Had they been, there would be more boosting and less objecting to a Coast Artillery Rifle Team.

Standing of Coast Artillery Members in National Matches, 1925

Entries	Members' Match	Navy Match	N.R.A. Any Rifle 600-yard	N.R.A. Rapid Fire 400-yard	N.R.A. Rapid Fire 200-yard	N.R.A. Rapid Fire Championship	Wright Memorial	Scott Match	Crowell Match	Individual Palma Match	Camp Perry Instructors' Match	Leech Cup Match	Chemical Warfare Trophy Match	Marine Corps Cup Match	Wimbledon Cup Match	N.R.A. Any Rifle 200 yard	President's Match	N.R.A. Individual Pistol Champ'nship	Any Rifle Championship	N.R.A. Grand Aggregate	National Individual Match
	964	763	348	777	824	507	494	494	494	494	247	1022	136	1084	983	347	1192	153	118	99	
Baird, Clair W., Major C.A.C.	33						85	10	55	16				127	132		112			62	
Barnes, Harry C., Jr., 1st Lt., 4th C.A.			64		18		49	76	64	23		14									
Brown, James D., Capt., 14th C.A.	144				129		22				23		23	2	19		28	9		8	
Burson, Thomas D., Sgt., 3d C.A.	210			212	129	125						213			207		100				
Crichlow, Robert W., Jr., 1st Lt., 9th C.A.											31							26			
Crolick, John, Cpl., 52d C.A.			74	122	236	116								74	62		251		29		
Frazer, William D., Major, C.A.C.		37	42	62		75					33				40				9		
Gooch, Homer A., Sgt., 52d C.A.					196							189		208							
Gotch, Edward W., Pfc., 63d C.A.C.		168														75					
Harkrader, Robert, Sgt., 4th C.A.	97	129	73	62	18	22		122						227		78	213		28		
Howath, John P., Sgt., 65th C.A.		189										188			66		249				
Latimer, David B., 1st Lt., 14th C.A.			33	17	59	9	87		111	118		195		116	210		137		26		
Lawton, William S., 2d Lt., 10th C.A.	93		41	32	59	20									194						
Lorren, John M., Cpl., 51st C.A.	201	45										223					237				
Loucks, Charles E., Capt., 51st C.A.	5	34		122			56	79				57					56			74	
Luce, Dean, 1st Lt., 64th C.A.												212		190			219				
McCullough, Samuel, 1st Lt., 51st C.A.	121		81	15	129	17	120	98	113	86				189	245	59	169		25		
McGarraugh, Riley E., 1st Lt., C.A.C.		31		122	2	29						130									
Mefford, Murrell, Cpl., 14th C.A.		175			129							220			152	74			27		
Murphy, Willard D., 1st Lt., 63d C.A.			77	177				102				250			82		193				
Nichols, George F., 1st Lt., 10th C.A.				17		54												7			
Simmonds, Norman B., 2d Lt., 11th C.A.	235				18	99								196			195				
Simpson, John W., Cpl., 63d C.A.									12					120							
Vandersluis, Howard J., 2d Lt., 14th C.A.	213				236		104							68	238						
Weeks, John A., 1st Lt., 6th C.A.	198													66							
Wilson, Charles F., 1st Lt., C.A.C.	48				59	91			42			137		37		42	6	13		11	10

Standing of Coast Artillery Teams

Matches	*Place*
Enlisted Men's Team Match	5
A. E. F. Roumanian Trophy Match	8
N. R. A. 600-yard Two-Man Team Match	7
N. R. A. 1000-yard Two-Man Team Match	7
The Herrick Trophy Match	5
National Pistol Team Match	5
The National Rifle Team Match	7

Note: The Canadian-United States Long-Range Match and the Palma Team Match were won by the United States Team. Sergeant J. P. Howarth, C. A. C., represented the Coast Artillery Corps on the United States Team.

Arkansas National Guard

FIG. 1. 206TH COAST ARTILLERY (A. A.) AT FORT SILL, OKLAHOMA

FIG. 2. 206TH COAST ARTILLERY (A. A.) AT FORT SILL, OKLAHOMA

COAST ARTILLERY BOARD NOTES

Communications relating to the development or improvement in methods or materiel for the Coast Artillery will be welcome from any member of the Corps or of the service at large. These communications, with models or drawings of devices proposed, may be sent direct to the Coast Artillery Board, Fort Monroe, Virginia, and will receive careful consideration.—R. S. ABERNETHY, Colonel, C. A. C., President Coast Artillery Board.

New Projects Initiated During the Month of October

Project No. 395, Sleeve Target for Antiaircraft Practice.—The Adjutant General requested that studies be made on recent antiaircraft artillery target practices with a view to recommendations regarding the practical size and design to insure visibility and the operation of sleeve targets for use in antiaircraft artillery target practice. This communciation was referred to the Coast Artillery Board by the Commanding General, Third Coast Artillery District, for recommendation.

Project No. 396, 155-mm. Gun Carriage Limber, Draw Bar Eye.—Reports were received from the Ordnance Officer, Hawaiian Department, that the draw bar eyes for 155-mm. gun carriage limber, model 1918, which have been reforged to change the diameter of the eyes of the lunette from 90 mm. to 4.75 inches are proving unsatisfactory in service in the 55th Coast Artillery, and that apparently smaller sizes of lunette eyes should be provided. The Coast Artillery Board was requested to report any trouble which may have come to its attention due to locking of the lunette eye and the pintle during maneuvers of 155-mm. gun materiel by means of 10-ton artillery tractor. The Board reported that no such trouble had come to its attention.

Project No. 397, Effectiveness of Fire.—This investigation was undertaken primarily for the purpose of deciding the method of manipulating the various 16-inch gun powder charges—three-quarters, seven-eights, and full—which would give the best results in firing at the proper target of a 16-inch gun, a first-class battleship. In order to accomplish this satisfactorily, it has been found desirable to devise a method of analysis which is somewhat novel. It is believed that the method may lead to a positive means for choosing satisfactory types of armament and also to a simple basis for comparison of the effect of fire from any one of a group of Coast Artillery batteries of various calibers.

Project No. 398, Fire Control Equipment to be Carried With a Battery of two 14-inch Railway Guns.—This project was taken up by the Board in accordance with the following extract of letter from the Chief of Coast Artillery:

> 1. In order that proper action may be taken on estimates now under consideration in this office, it is desired that the Coast Artillery Board study the fire control equipment necessary for a battery of two 14-inch railway guns and prepare three separate tables giving the following information subdivided by supply branches:
>
> (1) Fire control equipment required to be carried with a battery of two 14-inch railway guns *for general service.*
>
> (2) Fire control equipment required to be carried with a battery of two 14-inch railway guns *for service outside of harbor defenses.*
>
> (3) Fire control equipment required to be carried with a battery of two 14-inch railway guns *for service with field army in land warfare.*

Project No. 399, Musham Triangle Diagram.—A description of the Musham Triangle Diagram, a graphic method of solving triangles, was turned over to the Coast Artillery Board by the Commandant, Coast Artillery School, to determine its value as a check in computation of firing data. In the opinion of the Board this diagram cannot be advantageously used by the Coast Artillery, because it is neither quick enough in operation for fire against moving targets, nor accurate enough for fire against heavy artillery fixed targets.

Completed Projects

Project No. 392, Operation of Range Percentage Corrector.—

I—History of the Project.

1. It has come to the attention of the Coast Artillery Board that there exists a misunderstanding as to the operation of the Percentage Corrector.

II—Discussion.

2. Specifically, the question has arisen as to whether, when making corrections based upon observation of fire, the deviation should be determined in terms of percentage of the actual range or of percentage of the *corrected* range (actual range plus ballistic correction).

3. As regards the determination of deviation in terms of percentage of range by means of the impact board, lines 20-23, page 65, T. R. 435-221, are as follows:

> If the sliding piece be set so that the arrow points to the *range for which the piece is laid,* the deviation in terms of percentage of the range may be read opposite the deviation as announced in yards.

It was the intention of the Coast Artillery Board, when the Percentage Corrector was designed, that deviations would be determined in terms of percentage of the actual range, and the corresponding correction, in terms of percentage of actual range, be applied to percentage corrector by means of a slide "E," pointer "F" and scale "D" (see Fig. 10, opposite page 58, T. R. 435-221). The words, "range for which the piece is laid," were, and are, interpreted as meaning actual range. Certain officers have construed these words as meaning corrected range (which, is in fact the expression for elevation). In the illustrative example, subparagraph *e,* page 65, T. R. 435-221, deviations are determined in terms of percentage of the actual ranges.

4. In one instance a battery commander found, when analyzing his target practice, that the correction which had been applied to correct for a certain deviation, was not equal in yards to the deviation. The deviation had been applied properly to the percentage corrector in terms of percentage of actual range. An investigation showed that the correction given by the percentage corrector was the same percentage of the corrected range (actual range + ballistic correction) as was the deviation of the actual range. This relation between correction and deviation may be expressed thus:

$$\frac{\text{CORRECTION}}{\text{DEVIATION}} = \frac{\text{CORRECTED RANGE}}{\text{ACTUAL RANGE}}$$

In the instance considered, there was a very large ballistic correction.

5. Consider the following example:

From a series of trial shots fired at an actual range of 10,000 yards the ballistic correction was determined as *up* 15%, making the corrected range 11,500 yards.

With this corrected range of 11,500 yards, several shots were fired at a target the actual range of which was 10,000 yards. The deviation of the center of impact was OVER 500 yards. It is desired to correct for the entire deviation. Will a correction of DOWN 500 yards be the proper correction?

It seems reasonable to suppose that a change of elevation corresponding under normal conditions to a change of range of 500 yards will not result under the conditions considered (actual range, 10,000 yards; corrected range, 11,500 yards) in a change of range of 500 yards; but that it will result in a change of range something less than 500 yards.

It seems reasonable to suppose that, if an elevation corresponding to 11,500 yards be necessary to reach an actual range of 10,000 yards, in order to change the fall of the projectile by 500 yards, the elevation must be changed by an amount corresponding to something greater than the elevation change corresponding to 500 yards R at 10,000 yards.

It is believed that a close approximation to the proper correction will be obtained by assuming:

$$\frac{\text{CORRECTION}}{\text{DEVIATION}} = \frac{\text{CORRECTED RANGE}}{\text{ACTUAL RANGE}}$$

$$\frac{X}{500} = \frac{11{,}500}{10{,}000}$$

$$X = 575 \text{ yards.}$$

The same result will be obtained if the deviation be converted into percentage of the actual range, and this percentage of the corrected range be taken as the correction.

$$500 = 5\% \text{ of } 10{,}000 \text{ yards.}$$
$$5\% \text{ of } 11{,}500 \text{ yards} = 575 \text{ yards.}$$

In operating the Percentage Corrector, a correction based upon observation of fire is applied to the Percentage Corrector as a percentage of the actual range, such as to express the deviation (or that fraction of the deviation for which it is desired to correct) in terms of percentage of actual range. The total correction will be affected by this same percentage of the corrected range. (Deviation = x% of actual range. Corresponding correction = x% of corrected range. Total correction = ballistic correction + x% of corrected range.)

From theoretical considerations a closer approximation to the proper value of the correction than that given by the Percentage Corrector is given by the formula:

$$\frac{\text{CORRECTION}}{\text{DEVIATION}} = \frac{\text{CORRECTED RANGE} - \tfrac{1}{2}\text{ DEVIATION}}{\text{ACTUAL RANGE}}$$

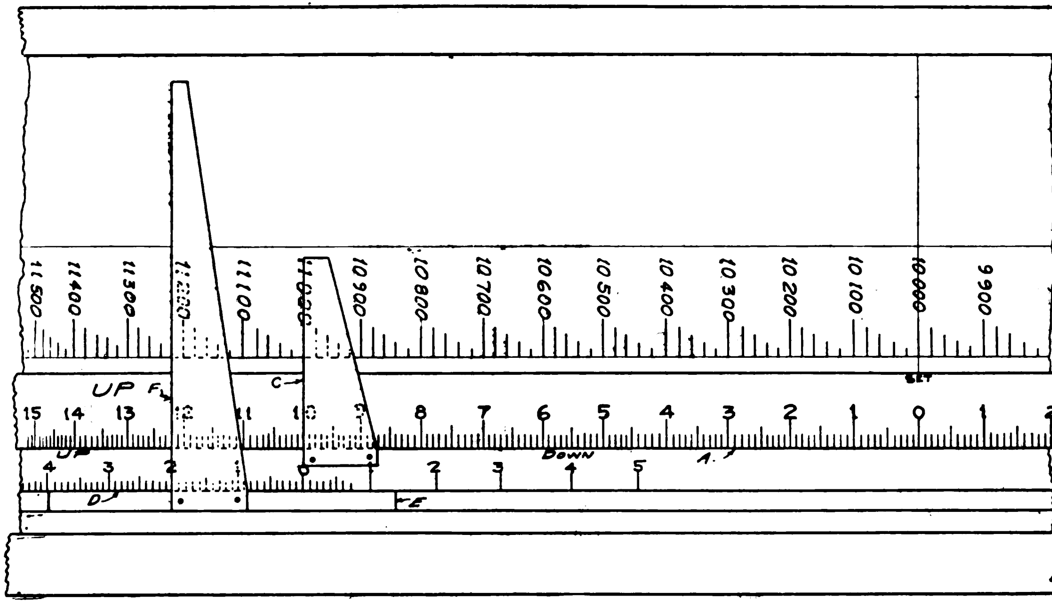
$$\frac{X}{500} = \frac{11{,}500 - 250}{10{,}000}$$

$$X = 562.5 \text{ yards}$$

Had it been desired to correct for a deviation of SHORT 500 yards the correction given by this formulæ would be 587.5 yards.

The value of the correction given by the Percentage Corrector, 575 yards, is closer to the theoretically correct value in correcting for a deviation either OVER or SHORT than is a flat correction of 500 yards.

6. The accuracy of the Range Percentage Corrector has been questioned because of the fact that the intersection of the pointer "F" with scale "A" is not



COAST ARTILLERY BOARD
FORT MONROE, VA

EXHIBIT "A"

OPERATION OF PERCENTAGE CORRECTOR
(PROJECT NO 392)

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the algebraic sum of the setting of the pointer "C" on scale "A" and the setting of pointer "F" on scale "D" (see Fig. 10, opposite page 58, T. R. 435-221). The difference between the values of the range scale appearing opposite the zero of scale "A" and pointer "C" will be the percentage of the range scale value appearing opposite the zero of scale "A" indicated by setting of pointer "C" on scale "A." That is, the scale "A" measures on the range scale percentage of the value appearing opposite its zero. Inasmuch as the actual range is set opposite the zero of scale "A," that scale measures percentage of the actual range. The difference between the values of the range scale appearing opposite pointer "C" and pointer "F" will be the percentage indicated by the setting of pointer "F" on scale "D" of the range scale value appearing opposite the zero of scale "D." Inasmuch as the zero of scale "D" (coincident with pointer "C") is set at the corrected range (actual range plus ballistic correction), scale "D" measures percentages of the corrected range.

Assume: Actual range = 10,000 yards. Ballistic correction = *up* 10%.

Correction based upon observation of fire = *up* 2%. (Deviation was *short* 200 yards and it is desired to correct for the entire deviation.)

Then 10,000 on the range scale will be opposite the zero of scale "A." Pointer "C" will be set at *up* 10% on scale "A" and will be over the value of 11,000 on the range scale. Pointer "F" will be set at *up* 2% on scale "D" and will be over the value 11,220 on the range scale.

Thus the total correction will be equal to 10% of the actual range + 2% of the corrected range. Diagram illustrating this condition is appended hereto and marked "Exhibit A." It is obvious that 10% of the actual range + 2% of the corrected range cannot be equal to 12% of the actual range, except when actual range and corrected range are equal.

III—CONCLUSIONS.

7. *a.* The Coast Artillery Board believes that converting the deviation (or that fraction of the deviation for which it is desired to correct) into terms of percentage of the actual range and then taking the same percentage of the corrected range as the correction is a closer approximation to the proper correction than is the practice of assuming the correction as equal to the deviation (or that fraction of the deviation for which it is desired to correct) regardless of the relation existing between the uncorrected and corrected ranges.

b. The Coast Artillery Board believes that the characteristics of the Range Percentage Corrector herein discussed should be taken into consideration in the analysis of target practice.

8. Whether or not it is always true that the method of reading the deviation as a percentage of the actual range and correcting by the corresponding percentage of the corrected range will give more accurate results than reading the deviation and making the correction as percentages of the same quantity, it would appear that there will result no substantial error from correcting by the most convenient method with the fire control instruments available.

a. Because the large corrections early in adjustment based on observation of fire are not, and cannot be, very accurately determined.

b. Because the corrections made late in the process of adjustment are so small that the difference in methods will not appreciably affect the result.

(NOTE.—This question came up not because of its effect on the adjustment but because of its appearance in an analysis of practice.)

IV—Recommendations.

9. The Coast Artillery Board recommends:

a. That T. R. 435-221 be amended as follows:

Insert the word "actual" in parentheses in line 21, page 65, after the word "range."

b. That this project be published in the Coast Artillery Journal.

V—Action by Chief of Coast Artillery.

1st Ind.

War Department, O. C. C. A., October 23, 1925.—To President, Coast Artillery Board (*Thru* Commandant, Coast Artillery School), Fort Monroe, Va.

1. The enclosed proceedings of the Coast Artillery Board No. 392, "Operation of Range Percentage Corrector" are approved.

2. Steps will be taken by the President, Coast Artillery Board, to have the entire proceedings published in an early number of the Coast Artillery Journal.

3. Training Regulations 435-221 will be amended as recommended in the Board's proceedings at the earliest date possible. In the meantime a letter will be written to all Coast Artillery District Commanders notifying them of the proposed change in this training regulation.

Nothing short of the power of repelling aggression will secure to our country a national prospect of escaping the calamities of war or national degradation.—*John Adams, Message to Congress, December 3, 1799.*

COAST ARTILLERY SCHOOL LIBRARY

BOOKS CATALOGUED

Unless marked thus "*" these books may be obtained by any Coast Artillery Officer; Warrant Officer, A. M. P. S.; or Noncommissioned Officer (Grades 1-3), C. A. C., upon request to the Librarian, C. A. S. Library.

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I have absolutely no sympathy with the claim that we were outgeneraled in that limitation of armaments treaty. The fact is that we got exactly what we proposed, and I am perfectly willing to accept the judgment of those who participated in that treaty that the battleship strength, at the conclusion of the treaty and of the scrapping, was substantially in the ratio stated in the treaty.—*Secretary Wilbur before the House Naval Committee.*

BOOK REVIEWS

COLONEL MITCHELL'S "WINGED DEFENSE"

A REVIEW, *By Sidney Ballou*

From *The Bulletin* (San Francisco) *Magazine*

The ancient wish, "Oh, that mine enemy would write a book!" never found more generous response than when Colonel Mitchell took his pen in hand. As the outstanding critic of the existing order of all things military, the public was warranted in assuming that behind one fiery newspaper statement after another there was a background of military knowledge and military science commensurate with the high rank and hard fighting experience which the colonel brought from the World War. When, however, a published book calls for a detailed exposition of views, a coherent line of reasoning and an adequate support of a thesis, the reader who hopefully turns the pages is left with a sense of disappointment. The familiar claims are there, but beneath them, in place of a solid foundation, there is vacuum.

There are those who believe that aircraft will play an increasingly prominent part in land and naval warfare, and who are genuinely curious to know how their manifest limitations are to be overcome. They want to know what is the actual effective radius of action of bombing planes, from what kind of a base they must start, how such bases are to be supplied and protected, and above all how such bases are to be pushed to within a few hundred miles of our coasts and maintained there against any sort of land or naval attack. They want to know if aircraft are really capable of seizing and holding a position, or if future wars can be won without this hitherto indispensable element, they want to be shown how. Students of the late war are curious for an explanation of why the seventy-two German Zeppelins, with a radius of flight and bomb-carrying capacity far in excess of any airplane yet flown, never succeded in interrupting for an hour the vital flow of men and munitions across the English Channel, within their easy reach. The man on the street today, listening to the claims of the air enthusiasts, is frankly puzzled to know why France and Spain, with their wealth of air equipment, cannot within twenty-four hours end their costly war against the Riffians, helpless under air attack.

No answer to these questions will be found between the covers of Colonel Mitchell's book. The aircraft of the author have no limitations. Radius of action ceases to exist on the second page:

> As the air covers the whole world, aircraft are able to go anywhere on the planet. They are not dependent on the water as a means of sustenation nor on the land to keep them up. Mountains, deserts, oceans, rivers and forests offer no obstacles. In a trice, aircraft have set aside all ideas of frontiers. The whole country now becomes the frontier and, in case of war, one place is just as exposed to attack as another place.

It is on stuff like this that the author's ideas of military strategy are based. St. Louis and Denver are just as exposed to attack as New York and Boston. It is specifically stated that such interior cities may be bombed. Where the aviators slept the night before is not revealed. Probably safe in the interior of Siberia.

It is true that there is an occasional reference to airplanes having to come to the ground, but that is usually with reference to enemy planes. The colonel's own planes soar with his imagination and neither touches the earth again.

> As air power can hit at a distance after it controls the air and vanquishes the opposing air power, it will be able to fly anywhere over the hostile country.

After all, why not? There are filling stations at every crossroads where white-coated attendants will not only fill up the enemy planes with gas, but will look at their oil and wipe their windshields. There are good hotels everywhere. Flying anywhere over a hostile country ought to be easy under these conditions. If there are any more complicated questions of supplies involved, the author apparently has never heard of them.

It is to the Navy, however, that Colonel Mitchell devotes most of his thunder. We are sufficiently familiar with the claim that aircraft have made all surface ships obsolete. It is something of a shock to find that the demonstration of this proposition begins and ends with the recital of the sinking, after two days' bombing of an old German battleship, anchored as a helpless target within easy reach of an air base.

It takes a great deal of ingenuity to make this exploit spell the final doom of all navies. This ingenuity is not lacking. First of all a huge straw man is set up by the repeated assertion that no one outside the air sevrice believed that a battleship could be sunk under these conditions.

It is a pity that this statement is not accompanied by specifications. It is tolerably certain that given time enough and bombs enough, with a supply base within reach, the Pyramids themselves could be destroyed. Who it was that believed that continuous unopposed bombing would not ultimately sink any anchored hulk is not revealed, nor does a search of contemporary service journals reveal this state of mind. However, it is necessary for the picture.

"Many considered," continues the narrative, "that neither could a battleship be hit by an aerial bomb, and, if it were hit, could it be damaged to any great extent."

Yet, as afterward related, these same skeptics had made elaborate preparations for determining the injuries done by the impossible hits. The tests were held off the Virginia Capes because "the majority of naval officers were so sure that the air attacks would prove ineffectual that it was desired to show as many congressmen as possible how little could be done by the air force." Believe it or not, particularly as half the bombing was to be done by the navy itself, a fact to which the author makes no reference.

Even the targets are glorified. The old Ostfriesland, which the Navy was unable to make watertight before the tests began, becomes an "unsinkable" ship with scars of the Battle of Jutland not mentioned in any official history.

Having stuffed his straw man to bursting, the colonel demolishes him with an exultant whoop. From his own account of the beginning it is evident that he has no sympathy with the acquisition of technical knowledge, that he proposes to allow no time for the examination of the effects of bursts, but that his one endeavor, orders or no orders, is to sink the ships in the shortest time possible.

When, at the close of the second day's bombing, the Ostfriesland finally goes down skeptics stand agast, strong men weep, and the Air Service goes home to celebrate the demonstration that "for all time aircraft dominate seacraft."

That is all. No discussion of how this force is to be used at any distance from a home base. No discussion of possible defenses, either present or to be developed. No comprehension of the gripping force of sea power, whereby a force of heavy ships lying out of airplane range in Scapa Flow could deny the seven seas to the enemy, even to the uttermost ends of the earth. It is as if an advocate of the tomahawk over the rifle had strapped dummies to a plank, demonstrated his deadly skill at twenty paces and loudly proclaimed that infantry was obsolete.

To those familiar with the events described, the author's omissions are as significant as his statements. The operation with the Iowa, for example, is described as a search for a battleship which when found was to be bombed with sand-loaded bombs. The search is described, but not the bombing. As this was the only case where the target was moving and the bombers restricted to the moderate altitude of 4000 feet, the fact that eighty shots resulted in only two hits may be assumed to be of some importance. It was certainly important enough to be omitted entirely from Colonel Mitchell's narrative.

It is not only by omissions, however, that the gallant colonel trifles with the truth. Plain misstatements of fact are abundant. Prominent among these is the repetition of the assertion that the dropping of 180-pound bombs on a target submarine badly damaged the condenser system of the directing vessel a mile and a half away. Not only was this denied when it was first published in a magazine article, but the author's own description of subsequent events shows how ridiculous it is. In the later tests with much heavier bombs the battleships are described as grouped around, so close that when the cruiser Frankfurt was hit flying fragments of steel caused the observers to seek protection. No casualties, to condenser systems or otherwise, are recorded.

It is in connection with this incident of flying splinters that the author sapiently remarks:

> It made one think what might happen in case of a real attack against naval vessels in war, whether the crews could be held to their posts in view of almost certain destruction.

One hardly knows whether to comment on the utter ignorance of naval history shown by this observation or on the danger of such twisted psychology in a high commanding officer. Anyone who makes war on the theory that the enemy can be scared into submission is apt to have a rude awakening.

As a matter of fact, however, the only form of major strategy which can be glimpsed in the pages of "Winged Defense" is founded on this very theory. It is by the bombing of cities that this new force aparently hopes to subdue a hostile country. It is in order to be free to carry out its own system of warfare, unhampered by armies fighting in the old-fashioned way, that Colonel Mitchell desires an independent air force. Under his inspiration a host of imaginative magazine writers are busy educating the American public in the belief that the proper way to win the next war is to fly in overwhelming force to the enemy's capital and drench it with poison gas.

We may leave aside the self-evident fact that this is contrary to the laws of civilized warfare and to half a dozen treaties to which this country has subscribed. Such considerations would only bring derisive smiles from the airmen. The point

to be emphasized is that this proceeding would neither win a war nor tend to win a war.

The only people who thought that the bombing of cities would help win a war were the Germans. Their theory was that it would cause an insistent clamor for peace from the civilian population. As applied to the British it had precisely the opposite effect. Yet we are now asked to adopt a theory not only discredited in practice but which brought its originators into conflict with the moral opinion and material force of half the world. Colonel Mitchell may have some ideas as to how force must actually be applied in order to end an enemy's capacity for fighting, but so far as the volume which he has offered to the public is concerned there is no suggestion that he has given the matter any consideration.

Even in the narrower domain of tactics the lack of consistent thought is such that one part of the book may be quoted against another almost *ad infinitum*. Thus, while discussing the establishment of airways, the author stresses the immense amount of preparation, including the assembling of supplies, which is necessary to make long distance flying practicable. When, however, the Pacific Coast is to be invaded by air from Asia, via the Aleutian Islands and Alaska, there is not a hint of any necessary preparation nor a suggestion of how such an expedition, without the aid of a navy, could be supplied en route.

The author relates, with pardonable pride, the success of his forces in blowing up ammunition dumps and otherwise harassing an important German center of supply. He continues:

> Of course, the Germans might have done the same thing to us if we had had a place behind our lines that was as important to us as was Fere-en-Tardenois to them. There was no such a place, because our troops were being supplied on converging lines, while theirs were being supplied on diverging lines from Fere-en-Tardenois.

Which is to say, that the most important function claimed for bombing aircraft in connection with military operations can be defeated by the simple device of dispersion.

In that part of the book devoted to civil aviation the colonel is on somewhat firmer ground yet there are not wanting revealing glimpses of his mentality. In the Philippines locusts can be herded by airplanes, in Hawaii aircraft are often the only means of telling whether irrigation has reached the center of a great cane field, while on the mainland aerial photographic negatives often show, from the character of vegetation and the color of the ground, what the best crop to be grown on the land should be. The successful use of aircraft for making rain is detailed, and future possibilities may be quoted for comparison with future military possibilities as judged by the same intelligence.

> Condensation of moisture is brought about by electrified particles of matter. Sand has been used so far, charged with a very high electric potential of an opposite kind from that found in the clouds. This sand is scattered around by aircraft in or over the clouds to produce the effect. The advocates of this method of producing moisture from the clouds have already laid plans for the watering of the arid regions, but instead of using sand they will use minute grass seeds which, after they produce the rain, will fall to earth and grow luxurious meadows where thousands of cattle can graze.

As a sporting proposition the Navy might agree to scrap their battleships when these cattle are ready for market. It is a positive relief when the author

goes on to assure us that the damages to the towns and bridges which will be washed away have been figured out and that this will be handled.

It is a truism that many a good cause suffers more from its fool friends than from its avowed enemies. So far as the need for an adequate air policy is concerned, with greatly augmented aircraft, both civil and military, few thinking men would disagree with Colonel Mitchell. It is the popular idea that the colonel, whatever his methods and eccentricities, is at least advancing this cause. When the question comes before Congress, however, where men demand to be convinced before appropriating the public moneys, it is doubtful whether the extravagant claims and unsound theories of Colonel Mitchell do not do the cause of sane and progressive aviation more harm than good.

Winged Defense. By William Mitchell, former Assistant Chief of the Air Service, U. S. A. G. P. Putnam & Sons, New York. 1925. 6"x 8¾". 261 pp. Ill. $2.50.

Colonel Mitchell has hastily gathered a number of his articles prepared for publication in the past few years and thrown them together with a few additional chapters into book form. According to the foreword:

> The book is intended to serve several purposes. First, that of putting down in words what the air men think about the organization of an air force and what our national defense should be. Next, to give to the people in general a book which will set before them facts about aeronautical development. And third, a book to which our people in the services, in the executive departments and in Congress can refer for data on aviation which is modern and which is the result of actual experience.

The statement of the first purpose now requires modification since naval aviation personnel has indicated its lack of entire accord with the Colonel's program. With slight modification, however, the book can be said to have accomplished its first purpose. As to its second purpose, this work leaves a lot to be desired. The average reader will gain some information about aeronautical development, but in this field the work is far from comprehensive. As to its third purpose, the book is a failure. Even Colonel Mitchell's most ardent supporters can hardly recommend "Winged Defense" as a reference book. Rather the volume is primarily a brief for an increased air force. More specifically, it is a brief for a reorganization of our national defense along the lines which he has ably advertised already,—i. e., to consist of one Department of National Defense with sub-heads for the Air, Army, and the Navy.

His arguments are not always supported in a forceful or logical manner. Bold and startling statements predominate, and are often unsupported by facts or reasoning. The author has accepted the bombing tests against defenseless surface craft as conclusive evidence of the complete superiority of aircraft over seacraft. But with all of its imperfections the volume contains interesting reading matter. This feature, however, is marred in part by unnecessary repetition.

The redeeming feature of the book is the author's genuine enthusiasm. He sees future wars fought and decided thousands of feet above the surface of the earth. The air force is to be the main factor with a small army and a submarine force as auxiliaries. The battleship, cruiser, destroyer, and naval airplane carrier, to him, are relics of the past.—C. S. H.

The Family and Early Life of Stonewall Jackson. By Roy Bird Cook. Old Dominion Press, Inc., Richmond, Va. 1924. 6¼"x 9¼". 96 pp. $2.00.

In the editor's preface Mr. Eckenrode says in part:

> It is the merit of Mr. Cook's little book that all the evidence bearing on the early life of Stonewall Jackson has been carefully sifted, so that the reader may be sure that what he finds bears the stamp of authentic history. Much new matter, garnered here and there, has been added: the result is that by far the most complete account of the youth of the great general is to be found in these pages. The notes on the Jackson family are also new and a most important contribution to the genealogy of famous Americans; they will be of interest to the many branches of the Scotch-Irish clan from which Stonewall Jackson derived his source.

The work, covering ninety-six pages, has been divided into ten chapters as follows: Chronology, Ancestry and Descendents, The Jackson Homestead—Jackson's Mills, Childhood, The Boy at Jackson's Mills, The Constable, The Appointment at West Point, West Point, Mexico and the Virginia Military Institute, Opening of the Civil War.

Throughout the book are copies of letters both to and from Jackson, during different periods of his life, which assist materially in giving a clearer insight into the real man. Twelve illustrations add to the value of the book.

This work will be interesting to all who would learn the early life of one of America's greatest soldiers.—H. B. H.

Warfare (A Study of Military Methods from the Earliest Times). By Colonel Oliver J. Spaulding, Field Artillery; Hoffman Nickerson, formerly Captain, United States Army; and Colonel John W. Wright, Infantry. Harcourt, Brace & Co. 1925. 6"x 8¾". 601 pp. $5.00.

The authors state the purpose and scope of their work as follows:

> The idea of the book is to give a narrative thread upon which to hang studies in institutions and methods, but not to attempt the impossible task of compressing military history into tabloid form. Evidently, the beginning of such a study should be the beginning of recorded history; the terminal point was not so easy to fix. For several reasons Frederick the Great was selected. First, he closed an era; after him began the epoch of our modern tactical systems. Furthermore, it chances that his wars coincide in time with the later American colonial wars, in which the reciprocal influence of Europe and America began to show itself. Just after him came the great French Revolution, in which the influence of the American Revolution was brought to Europe, not only in civil but in military fields.
>
> A knowledge of the development of military art and science down to include Frederick, then, is necessary to anyone who would understand the wars since his time. But this knowledge, while it must be accurate, may be general. Study of later events and developments must be much more detailed, since it is study of an epoch in which we are still living. Hence this book does not go beyond him; it merely points out, in conclusion, the general tendencies of the times immediately following his death, and seeks to orient the student who wishes to go further.
>
> In so far as practicable, the work is based upon contemporary authorities. The materiel, meagre for the earlier times, approaches the vanishing point for the Dark Ages, and then gradually grows more abundant and more precise as we approach our own days; for the later periods it has been possible to examine and compare the statements of responsible participants in the events described, in England, France, Germany, Spain, and Italy. The bibliographies attached make no claim to completeness. They include only a fraction of the number of books examined; but they contain a brief comment upon those found most useful, and may serve as a guide for further investigation.

In the preface General Bliss says in part:

> In the remotest antiquity individual man discovered the basic principles in the science of war when he learned that in single combat his success depended, first, on his bringing to the contest his own body in the perfection of its physical powers, and, second, in bringing that body to bear against his adversary in such a way as to ensure his delivering a completely effective blow. In that are comprised both the art and the science of war. The art grew with the perfection of the means by which the larger and larger groups of men were best enabled to do what individual man had learned that he must do with his single body.
>
> The process of evolution of every science, that is, of every great separate branch of knowledge the basis of which is demonstrated law, shows that as the arts upon which it depends become more perfected there are constant changes in methods but no change in principles.

A study of military methods covering a period of forty-eight hundred years in one volume must necessarily be limited in scope. The authors, however, have selected the wars and campaigns best suited to illustrate the development and progress in tactics, arms, and weapons. These they have treated in sufficient detail to give the student a good general idea of the points in question.

The book is most interesting and instructive. It shows that the authors have spent much time in research. The bibliographies, although making no claim to completeness, list numerous works on the periods covered with a comment on each one listed. The subject is treated in three sections, as follows:

Ancient Warfare: to the death of Julius Cæsar,
Warfare in the Roman Empire, the Dark and Middle Ages, to 1494 A.D., and
Warfare in Modern Times: to the death of Frederick the Great.

Thirty-six plates are inserted to illustrate the battles and campaigns considered.

It fulfills the purposes of the authors in every way and should be among the books of every student of tactics.—H. B. H.

Braxton Bragg, General of the Confederacy. By Don C. Seitz. The State Co., Columbia, S. C. 6½"x 9¾". 544 pp. $5.00.

The campaigns and battles of the American Civil War, by their very nature, are tremendously interesting to readers both American and foreign, military and non-military. Time has detracted little from the fascination of this period of American history. Indeed, since the World War it has become almost a fad among military students to study the war between the states and make comparisons with the late studendous struggle. The story of the military career of Braxton Bragg, naturally devoted largely to the Civil War, is no exception in point of interest. Though quiet and retiring, Bragg was a strong character, courageous and capable. A much-hated general and one whose military efforts led to defeat, his career has not attracted wide attention. Military students will doubtless heartily greet this study of his life.

In the Mexican War, Captain Bragg showed his courage as a fighter and earned a nation-wide reputation as an Artillery commander under General Taylor at Buena Vista. Early in the Civil War he displayed ability to organize, supply, and conduct an army. In 1862 he was placed in command of the Confederate forces in Tennessee. He soon made a reputation as a stern disciplinarian. The fighting qualities of that army were due largely to his efforts and leadership. His main difficulty in that army was with his subordinates, for never was he able to arouse that loyal and enthusiastic support which marked Lee's campaigns. More than one of his generals frankly advised him that his replace-

ment would be beneficial to the army. Yet the army under Bragg fought, and fought skillfully, some of the hardest battles of the war. A brief study of Stone River or Chickamauga will establish that fact.

The author has quoted freely from Bragg's dispatches. While these papers show a tendency of the Confederate leader to criticize and find fault, they also show his ability to separate the essential from the non-essential in the preparation and conduct of war.

His career is worthy of study and the author has succeeded in giving us a narrative which is quite readable.—C. S. H.

Mesopotamia, 1914-1915. By Captain Henry Birch Reynardson. Andrew Melrose, Ltd., London. 1919. 5½"x 7¾". 272 pp. Ill. Price 9*s*.

In this interesting and rather chatty book Captain Reynardson describes the operations of the first expedition to Mesopotamia, carrying the account of operations to the close of the year 1915. Being a member of the expeditionary force, the author has recorded at first hand his impressions. As a result the book expresses a little geography, a little ancient history, a little polo and bird shooting, some transportation difficulties, and some description of the natives and their customs, as well as military operations.

The book is interesting and easy to read, and it covers some phases of the Mesopotamia Campaign concerning which not a great deal has been written. It is recommended as an introduction to a study of the defense at Kut-el-Amara and the subsequent operations in Mesopotamia.—R. A.

A Political and Social History of the United States, 1492-1828. By Professor Homer C. Hockett. The Macmillan Company, New York City. 6"x 8¾". 1925. 438 pp.

A Political and Social History of the United States, 1492-1828. By Professor Arthur M. Schlesinger. The Macmillan Company, New York City. 6"x 8¾". 1925. 576 pp.

These companion volumes form a continuous history of the United States from the beginning up to the present, clearly written, authoritative, and forward moving. Two features of this joint work attract at once the attention of the reader. The first is indicated in the title. The second is in accord with the modern expansion of our activities and interests.

The authors have attained a high degree of success in their attempt to portray vividly the actual living conditions and customs of our peoples in the successive stages of our national development. "Though the major emphasis rests upon the political development, political forces are regarded as constantly responsive to the changing phases of social, cultural, and economic conditions." And so we find such headings as "Provincial America," "Urban Life," "Relations between Frontier and Coast," "The Revolution in Manfacturing, Transportation, Mining, and Communication," "The Trend toward Large Scale Industry," and "The Rise of the Silver Movement."

The second feature is the effort made to tie in correctly American history with that of the world. "American history is pictured not as an isolated development but as part of the great world stream of events, being touched at many points by influences from abroad, both in times of war and peace."

This record of American development is well balanced and well written, authoritative as to facts recorded and fortunate in the interpretation of issues involved. It is admirably designed to correct erroneous impressions formed from

earlier study or readings. Unfortunately most of us have fallen into such incorrect impressions, impressions derived from the study or reading of histories written in an excessive vein of patriotism, or sometimes written in an effort to cater to local prejudices.

The work is intended primarily for use as a college text. However, it is couched in such language as to be clearly understood by students with less preparation. Its scope of subject matter and manner of presentation make it attractive also to the independent reader. They are fortunate, indeed, who find the opportunity to study and reflect upon the contents of these two volumes.—C. S. H.

The Shadow of the Gloomy East. By Ferdinand A. Ossendowski. E. P. Dutton & Son. 1925. 6"x 8½". 203 pp. $3.00.

In this volume Dr. Ossendowski, a Pole who lived many years in Russia, has painted a word picture which will give the reader a very good understanding of the background of Bolshevism, Sovietism, and Communism. He pictures the true Russian of all classes, all of which—the upper (before the Revolution,) the middle, and the lower,—due either to ambition or ignorance, indulged in many forms of corruption and followed some perverted religion. Murder seemed to be a pastime. Witchcraft and other debased forms of spiritualism occurred in ordinary life as though in a story. He follows the so-called monk, Grishka Rasputin ("the former horse-thief, drunkard, and profligate"), through many of his schemes which show why "In Siberia, where Grishka was hated, today already, during the Bolshevist regime, people whisper: 'Rasputin was a dog, but a strong, supernatural man.'" Many other notorious characters are introduced.

The following chapter headings will give some idea of the story presented: The Masks, The Face Laid Bare, The Shadows of the Village, The Treasure Hunters, The Poisoners, Heathenism, Witchcraft, The Echo of the Dim Past, The Bold Industry, The Lords of the Sea, In the Dusk of the Palaces, Black Shadows, Phantoms of the Apocalypse, Ascetics versus Antichrist, Factories of Immorality, Woman and the Child, Death of the Romanovs and the Mystical Movement, Black Ravens, Old Gods in Christian Worship, The Simplest of All Gods, The Devil's Feast, Witte, Stolpin and Goremykin, The Last of the Mohicans, Fetishism of the Word, Chaos, Conclusion.

In the Conclusion the author says in part:

> I perceive distinctly the danger threatening Christian civilization from the East, but not from the real East, which endures in its mystic reverie or its hallowed majesty, defending its culture and independence against the pernicious influences of the new-comers. I perceive the menace of the East, in whose vanguard marches the Russian multitude of Mongolian half-breeds, followed by swarming hosts of utterly despondent Asiatics, burning with hatred, demoralized and revolutionized by Soviet diplomatists, with the blood-stained gold taken from the murdered, broken off the sacred images and crosses, carried away from temples of learning.

Granting that Dr. Ossendowski may perhaps have exaggerated somewhat, his message is an important one and it has been presented in a most interesting manner.—H. B. H.

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UK-11	Journal of the Royal Artillery.
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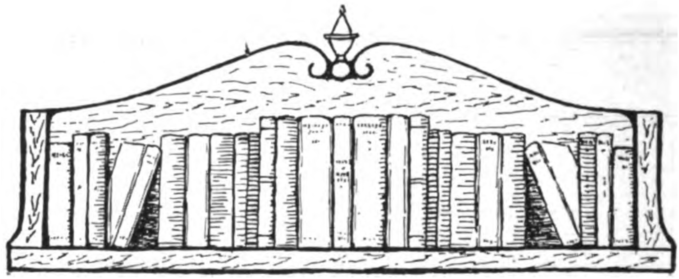

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